# Successful Opening of the Telephone Line Between London and Paris.


# ELECTRICAL REVIEW

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## Electric Light, Power, Telephone, Telegraph and Scientific Progress.

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### VIEWS, NEWS AND INTERVIEWS.

"Even a layman can see how rapidly the electrical industry is growing," remarked the agent of a large office building in this city. "An evidence of this rapid growth occurred in my own experience. About a year ago, two young electrical engineers applied to me for an office. They were just starting an engineering company, and wanted to spend about $15 or $20 a month in office rent. I told them I was sorry I could not accommodate them at that price. Only the other day the same young men rented an office of me at $1,000 a year, and say they will take the adjoining room as soon as the present tenant vacates it."

Thomas A. Edison and several well-known engineers have been invited to appear before the Aldermanic Committee on Railroads this week and make suggestions for lighting the Fourth avenue tunnel.

It was rumored last week that an English syndicate was negotiating for the purchase of the Westinghouse interests. Mr. George Westinghouse, Jr., was in New York a few days ago and denied that there was any truth in the rumor.

The Hoosac Tunnel, in Massachusetts, has been lighted by electricity for several years past in a perfectly satisfactory manner. The New York Central Railroad is respectfully referred to this engineering work as a shining example of what electricity can do in illuminating dark places.

### LITERARY.

"Education at the Michigan Agricultural College: Its Scope, its Method and its Results," by President O. Clute, has been received.

"Transactions of the American Institute of Electrical Engineers," for March, 1891, contains "Report of High Speed Railway Work," by O. T. Crosby," and "The Inventions of Thomas Davenport," by Franklin Leonard Pope.

We have received the annual catalogue of the Massachusetts Institute of Technology for 1890 and 1891. There are 937 students at the Institute this year. The Class of 1890 graduated 102 men, of whom 19 took the four years' course in electrical engineering.

"Sixth Annual Report of the Board of Gas and Electric Light Commissioners of the Commonwealth of Massachusetts," issued January, 1891, contains the following information:

The last year, 73 gas companies and 60 electric light companies made returns.

It is suggested that a penalty be affixed when companies fail to report within the time required by law.

Notwithstanding the steady progress of electric lighting, it still appears that there has been, in a large majority of places, a gradual increase in the consumption of gas.

The Board suggests that people who question the fairness of price for light present their complaints in writing, as it is a question which cannot be acted upon hastily.

During the year 1890, there were five persons injured, three of them fatally, by electricity from electric light plants, and 23 persons were injured by illuminating gas, eight of them fatally. Of the latter number, two committed suicide by inhaling gas, and another, it is suspected, was intentionally subjected to it.

The total number of deaths by inhaling illuminating gas in the United States in 1890, as reported to the Board, from various sources, was 174. In the accounts thus given, it appears that 35 of the number were cases of suicide, leaving 139 which are supposed to have been accidental.

### Electric Lighting Notes.

The Narragansett Electric Lighting Company, of Providence, R. I., has declared a dividend of $1 per share, payable April 1.

The Thomson-Houston Electric Company has recently booked orders for 750 motors, so that this department can see its business ahead up to next July.

The Eastern District Electric Light and Power Company, Brooklyn, organized with capital of $300,000. The trustees are: Thomas H. Banchle, Edward S. Seeley, Theodore Dow, Charles A. Smylie, Henry H. Downes, Stephen J. Burrows and Thomas Black.

### The Loomis System of Electric Lighting.

Our handsome illustration on this page, Fig. 1, shows the Loomis dynamo, a very compactly built and well designed machine. The chief claim of its inventor, Mr. Osborn P. Loomis, is that this dynamo is entirely automatic, requiring no more attention than a line of shafting. To quote from a handsome catalogue recently issued by the Eureka Electric Company, 18 Broadway, this city, which controls the Loomis system: "Careful expert tests show that this perfect self-regulation, instead of being obtained at a cost of wasted power, spent in driving its current through resistance coils, or driving a dynamo, whose brushes have been purposely removed from their position of maximum efficiency, in order to weaken the current, exhibits a degree of economy in the use of power, hitherto unknown."

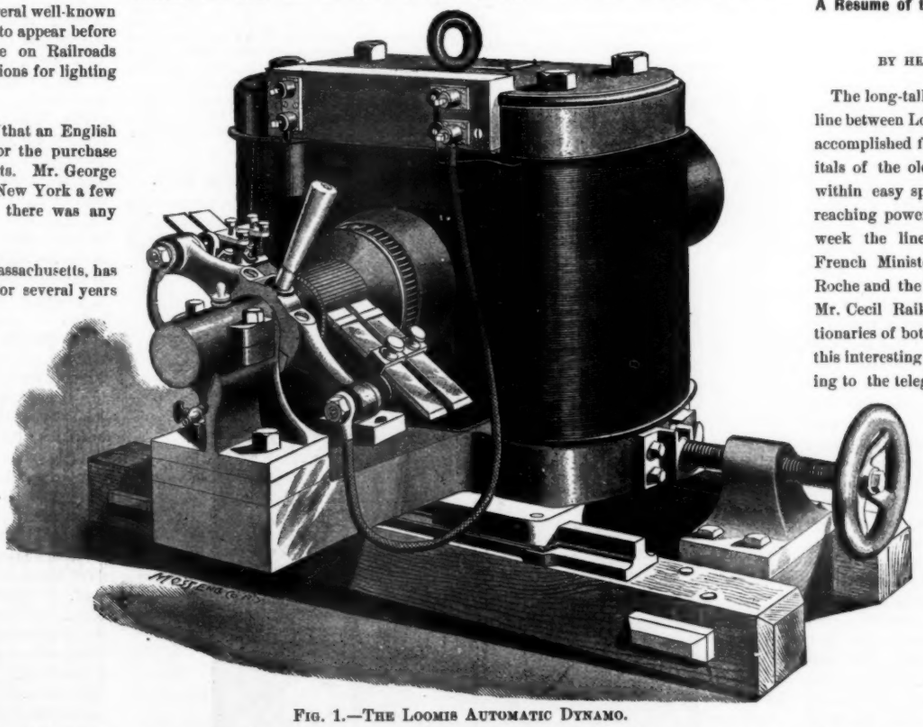


FIG. 1.—THE LOOMIS AUTOMATIC DYNAMO.

The system is adapted to both arc and incandescent lighting and includes every requisite device and safety appliance necessary to the economical operation of an electric lighting plant.

In Figs. 2 and 3 are shown the Loomis ammeter and the Loomis ground detector. Voltmeters, double and single pole switches, main and branch cut-outs, rosettes, etc., all by the same inventor, are used in this system. Every piece of apparatus is made strictly in conformation with the rules and regulations of the Board of Underwriters.

The list of plants installed by the Eureka Electric Company is rapidly increasing in length. If testimonials go for anything, the Loomis system is a most popular one. In the ELECTRICAL REVIEW of November 15, 1890, the handsome plant installed by this company in the Vanderbilt Building, New York, was fully illustrated and described.

## THE GREAT TELEPHONE LINE.

### A SUBMARINE TELEPHONE CABLE ACROSS THE ENGLISH CHANNEL.

### Paris and London Conversing With Ease.

A VERY INTERESTING AND VALUABLE DESCRIPTION OF THIS WORK.—ONE OF MUCH IMPORTANCE TO TELEPHONE PROGRESS OF THE FUTURE.—SPECIAL CABLEGRAM FROM MR. PREECE.

### A Resumé of the Progress of International Telephony.

BY HERBERT LAWS WEBB.

The long-talked of international telephone line between London and Paris is at last an accomplished fact, and the two greatest capitals of the old world have been brought within easy speaking distance by the far-reaching powers of modern science. Last week the line was inaugurated by the French Minister of the Interior, M. Jules Roche and the English Postmaster-General, Mr. Cecil Raikes, various other high functionaries of both countries being present at this interesting international event. According to the telegrams received by the daily papers, the operation of the line, as regards good transmission of speech, is all that could be desired.

THE HISTORY OF INTERNATIONAL TELEPHONY

can be summed up in very few words. There is a line from Paris to Brussels, which has been remarkably successful from the date of its inauguration; the distance is only 190 miles, and the line being all overland no particular difficulty was met with in securing good working conditions. The second international telephone line, and the first in which a submarine cable was included in the circuit, was established between Montevideo, the capital of Uruguay, and Buenos Ayres, the capital of the Argentine Republic. This line was completed and opened for public service in October, 1889. The total length of the line is 199 miles, of which 171 miles are overhead wire and 28 miles submarine cable, crossing the mouth of the Rio de la Plata. For the overhead portion of the line an extraordinarily heavy wire was used, the material being of phosphor-bronze of $\alpha$ conductivity of 90 per cent. of that of pure copper; the wire weighs 890 pounds per mile, and has a resistance of .885 of an

ohm per mile. The submarine cable has a resistance of 5.3 ohms per mile (statute) and an inductive capacity of about .322 microfarad per mile.

THE LINE IS METALLIC CIRCUIT THROUGHOUT,

two separate cables, each with a single conductor, being used for the river crossing. The KR of this line has always been given as 10,400, and, at the same time, the transmission is said to be excellent. According to Mr. Preece's formula, 10,000 is about the highest KR at which speech is "good," and, therefore, the results obtained with the Buenos Ayres line appear surprising. In this case, however, the KR is not correctly calculated. The total resistance of the line is taken as being 582 ohms, and the total capacity as 18 microfarads. This latter value is the total capacity of the 56 miles of submarine cable; but as the cable is looped, the figure is four times too high. The capacity of the 171 miles of overhead line is neglected entirely. Assuming the aerial wire to have a capacity of .0165 microfarad per mile, the total capacity of the loops would be 1.41 microfarads. The capacity of the loop of 56 miles of cable would be 4.5 microfarads. Therefore, the total capacity of the metallic circuit is 5.91 microfarads. Taking the total resistance of the circuit to be approximately 600 ohms, we have for KR only 3,546, instead of 10,400. It is clear from this that there is no cause for surprise in the excellence of the transmission over the Montevideo-Buenos Ayres line; in fact, any other result would have been surprising, in view of the very favorable electrical conditions of the circuit.

TO RETURN TO THE LONDON-PARIS LINE.

This project has been under consideration by British and French telegraph authorities for some time past. At the Newcastle meeting of the British Association, in 1889, Mr. Preece read a short paper on the subject, pointing out that the distance between the two cities (275 miles) constituted no serious difficulty, but that the necessity of using a submarine cable in the middle of the line, and a certain amount of underground work at each end, introduced obstacles that had to be surmounted. Experiments had been made with artificial cables and with circuits having similar electrical conditions to those that the proposed line would have, and the results were in every case satisfactory.

Last year, at the Leeds meeting of the British Association, Mr. Preece returned to the subject in a paper on "The Form of Submarine Cables for Long Distance Telephony," in which he said that the overhead wires were then being built by the respective governments and that a cable of special type would shortly be laid across the Channel from Dover to Calais. The proper size of the cores of the cable had been determined by mathematical investigation, and a core containing 160 pounds of copper, and 300 pounds of gutta-percha per nautical mile had been decided on; the resistance to be 7.55 ohms and the capacity .3045 microfarad per nautical mile. The complete cable contains four of these cores laid up together, served with tanned yarn and sheathed with 16 No. 2 B. W. G. galvanized iron wires. The overhead wires were to be of hard drawn copper weighing 400 pounds per mile, and having a resistance of 2.25 ohms, and a capacity of .0156 microfarad per mile. The KR of the line constructed in this manner was estimated at 5,900, a figure which augured well for good speaking.

SPECIAL CABLEGRAM FROM MR. PREECE, OF LONDON.

As we have seen, the line has been completed and is found to work well, but telephone men all over the country will be glad of some further details, technical and general. A private telegram received from Mr. Preece, last week, gives some interesting information, both as to the working of the line and various details of construction. The transmission he describes as being "splendid," and the two circuits are absolutely quiet, being wholly free both from outside induction and from "cross-talk" from one to another. The overhead wires are "transposed," or twisted around each other regularly throughout the line. Each wire makes a quarter of a turn between every pair of poles, thus in four spans a complete revolution is made, and the average distance of the two sides of each circuit from external disturbing influences and from each other is preserved the same throughout. The same relative disposition of the circuits is preserved in the submarine portion of the line, by the "lay" of the cores in the cable, the two cores which are diametrically opposite each other being used for each circuit. The English portion of the overhead line is built

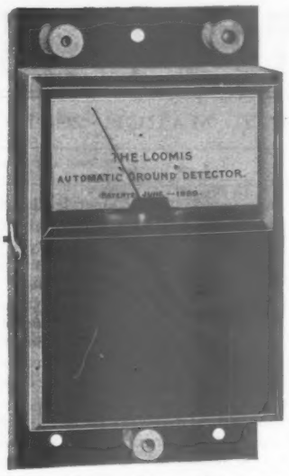



FIG. 3.—LOOMIS GROUND DETECTOR.

of hard drawn copper wire weighing 400 pounds per mile, and the line is run overhead directly to the London terminus. In France a wire weighing 600 pounds per mile has been used, and in Paris the circuit is completed through an underground cable 4½ miles long. Unfortunately the electrical conditions of this underground cable are not stated, but Mr. Preece gives the KR of the line as being about 5,000; this figure seems a trifle low, as we shall presently see.

The distance from London to Dover is 70 miles, the length of the submarine cable across the Channel is 21 knots, and the distance from Calais to Paris is 180 miles, of which 175.5 miles are of overhead wire and 4.5 miles underground cable. The resistance per mile of hard drawn copper wire, weighing 400 pounds per mile, is 2.225 ohms at 60 degrees Fahrenheit, and the capacity .0156 microfarad. The resistance of the 600 pound wire is 1.4835 ohms per mile, and the capacity .016 microfarad. Taking the temperature of the cable as being 40 degrees Fahrenheit, the resistance per knot would be 7.016 ohms and the capacity .3045 microfarad. For the circuit of overhead and submarine line, therefore, without counting the underground section in Paris, we have a total resistance of 1126.9 ohms, and a total capacity of 5.1472 microfarads, giving for KR just 5,800.

The 4½ miles of underground cable may add considerably to this. If the cable is made up of the class of gutta-percha covered wire generally used in Europe for underground work, the resistance may be taken at 10 ohms per mile and the capacity at .38 microfarad. This would bring the total resistance to 1216.9 ohms, and the total capacity to 5.8897 microfarads, making KR= 7,167. It is understood, however, that the French government was to have constructed a special type of underground cable for this line, the wires to be of low resistance and kept apart by wooden blocks or beads, securing practically a dielectric of air, and consequently a very low inductive capacity. Assuming this cable to have been used, and taking its resistance at 1.48 ohms per mile and its capacity at .05 microfarad per mile, we have, for the entire line, a total resistance of 1140.25 ohms and a total capacity of 5.2595 microfarads; in this case, KR= 5,997 or, in round numbers, 6,000.

TELEPHONIC COMMUNICATION SUCCESSFULLY ACCOMPLISHED.

Although this is slightly higher than the figure given by Mr. Preece, the fact remains, on the authority of his telegram, that speech is "splendid" and that the circuits are absolutely silent and without "cross-talk." The successful working of the line is therefore assured, although but little misgiving could have been entertained on this score by those familiar with the present state of the telephonic art. The establishment of a telephonic communication between the two countries, separated by even such a comparatively insignificant branch of the ocean as the English Channel, is a peculiarly interesting and fascinating event, because one naturally thinks, more than of the actual number of miles from point to point, of the many distinct features which separate more than mere distance, such as the difference in the climate and soil of the two countries, and in the speech and character of the people inhabiting them. It is certainly a red-letter day in the history of the telephone that sees Gaul and Briton chatting together, each in his respective capital.

FIG. 2.—LOOMIS AMMETER.

### The Air Ship Not Flying High.

Unless Inventor E. J. Pennington, of Chicago and air ship fame, satisfies a judgment against him in favor of B. Beltman & Company, of Cincinnati, for $415, a rude officer of the law will go to the Exposition Building and attach the world-renowned air ship and stow it away until the judgments are paid.

Several magazine articles have been recently written on the "Future of Invention," or some such title, accompanied, in one instance, by flippant illustrations. Dealings with the future are hazy, even in less intricate subjects than invention. Space writers would better let this subject take care of itself, as it is well able to do, without any idle speculation on the part of the writers. But if something must be written, let it at least avoid being flippant, either pictorially or otherwise.

## NEW ENGLAND NOTES.

**Brown & Sharpe Manufacturing Company,** Providence, R. I., is building a new four-story brick factory to be devoted to the manufacture of small tools.

**Mr. John Waring,** electrician Perkins Electric Lamp Company, Manchester, Conn., has secured a patent for an electric tachometer, which is claimed to be constructed on an entirely new principle.

**Mr. Charles E. Bibber** has tended his resignation to the Holtzer-Cabot Electric Company and has accepted the general managership of the Consolidated Electric Manufacturing Company, of Boston.

**The Athol Gas and Electric Company** has been organized at Athol, Mass., with a capital stock of $25,000. The following officers were elected: President, G. C. Moses; treasurer, J. H. Bickford; secretary, F. R. Davis.

**Winchester, N. H.,** will soon have an electric light station. The town authorities warmly advocate the streets being lighted by electricity, and the matter will be submitted to the citizens at an adjourned meeting May 1.

**Electric Road in Pittsfield, Mass.**—The directors of the street railway in the town mentioned, have completed arrangements for equipping their road with electricity. The road, with its new mode of propulsion, will be in operation on or about June 1.

**Messrs. E. M. Carhart & Company,** Providence, R. I., manufacturers of the Thomas mast arm, are enjoying a heavy demand for their popular product. This meritorious mast arm possesses peculiar and economical features which recommend it to all electric light companies.

**The American Bell Telephone Company** will hold its annual meeting March 31, in its new building, corner Milk and Oliver street, Boston. It is expected that the company will remove from its present offices, No. 95 Milk street, the first week in April, and will occupy the sixth and seventh stories of the new building.

**The Westinghouse Electric Company,** through its New England agent, Mr. F. P. Barnes, has closed two additional contracts with the new electric light company at Manchester, N. H. One contract is for a second 750 light Westinghouse alternating machine, to be installed at once, and the other order is for the third machine, of same capacity as the other two, to be put in position July 1, making a total lighting capacity of 2,250 lights.

**New Welding Process.**—A patent has been recently granted Hermand Nerup and L. M. Schmidt for a new method of electric welding, the process being to form longitudinal joints by a soldering, cementing or welding operation, by feeding the pieces through suitable pressure or other devices while properly arranged so as to be pressed together and passing a heated electric current through the material in a longitudinal direction before it reaches the welding devices.

**Inspection by Governor Russell.**—On Monday, March 30, Gov. W. E. Russell and staff, of Massachusetts, will visit Lynn, Mass., and inspect the extensive works of the Thomson-Houston Electric Company. The governor and party will leave Boston on a special car, arriving at central station, Lynn, at 2.40 P. M., on date above named. A committee of prominent electrical people will meet the governor at the station and escort him and his staff in carriages to the Thomson-Houston Electric Company's works.

**Mr. Chas. B. Burleigh,** of the Thomson-Houston Electric Company, is acknowledged to be one of the most genial and agreeable fellows among the electrical people of this section. Mr. Burleigh's popularity was put to a test recently, and in this way: A voting tournament was held last week by the Powhattan Tribe, No. 40, Independent Order of Red Men, of Chelsea, Mass., at which the most popular superintendent of the Order was voted for at ten cents per vote. Thousands of these votes were purchased by friends of the candidates, and Mr. Burleigh's admirers contributed nearly 5,000 votes and secured the coveted prize for their favorite. W. I. B.

## OUR ALBANY LETTER.

**Senator Laughlin's Bill** to incorporate the Buffalo and Niagara Power and Drainage Company was ordered to a third reading.

**At the Thursday Evening Session,** Mr. Byrne's bill requiring the lighting and ventilation of railway tunnels was ordered to a third reading.

**In the Assembly** Thursday, Mr. Roche's motion to disagree with the adverse report on his bill reducing telephone rentals in New York was lost by a vote of 40 to 64.

**Glens Falls, N. Y.,** is to have an electric street railway. The rails and track material are expected in a few weeks, and by July the new electric system will probably be in operation.

**Newburgh, N. Y.,** is having its electric light and telephone poles about the city painted an olive green. It requires considerable paint to cover an 80 foot pole. When the work is completed, all the smaller poles will be removed.

**The Board of Railroad Commissioners** has approved of the application of the Harlem Bridge, Morrisania and Fordham Railway Company for authority to change its motive power from horses to the overhead single trolley system upon the routes of the company in New York city.

A **Bill** has been introduced in the Senate by Mr. McNaughton, creating two new State railroad commissioners, one to be a telegraph operator, recommended by the Knights of Labor, Federation and State Trades Assembly, and the other a "working farmer," recommended by the Farmers' Alliance.

**The Hudson River Telephone Company's** Albany lines have not yet recovered from the storm and crossed wires. Many telephones were burned out and a temporary switchboard has been substituted for the one destroyed by the fire in the central office. The company is doing all in its power as rapidly as possible to straighten out the "hello" system.

**Mr. Deane** has introduced a bill in the Senate providing that local authorities in cities and villages to whom application is made by any electrical company for the use of streets for poles, wires, subways, etc., must sell the franchise to the corporation bidding the biggest percentage of its gross receipts; all consents already granted are validated.

**Mr. Sulzer** introduced a bill in the Assembly providing that steam railroad tunnels in New York shall be ventilated by such mechanical or other devices or appliances as shall keep them clear of smoke, steam and such other atmospheric impurities as render traffic dangerous, and such tunnels shall also be sufficiently lighted either with electric or other light.

**The Scheme of Rochester, N. Y.,** parties to construct an electric road from Rochester to Niagara Falls, along the line of the old Ridge road, is assuming definite shape. It will give Niagara county another line to Rochester and open up a magnificent stretch of country. Nearly every one who has been asked along the proposed route has signed the consent, and the affair is running along very successfully.

**The Albany Railway Company** had a hearing before the Assembly Railroad Committee, Tuesday, on reducing the fare to five cents, as provided by a bill introduced by Mr. Ward. Supt. McNamara offered the committee a substitute bill providing that when the railway commissioners certified that the earnings of the company from all sources were ten per cent. above the road's expenses the fare should be at once reduced to five cents. No action has yet been taken.

**The Assembly Committee** on gas, water and electricity, will report favorably Mr. McKenna's bill fixing the price of gas in Long Island City, amended by making the price $1.75 instead of $1.50 per thousand feet; and Mr. Southworth's bill approving the agreement between the Board of Electrical Control in New York city and the Empire City Subway Company and the Consolidated Subway Company. The committe reports adversely Mr. Roche's bill fixing the rental for telephones in cities of more than 500,000 inhabitants at $75 per annum. L. M. W.

Albany, N. Y., March 21, 1891.

### Novel Electric Power Scheme.

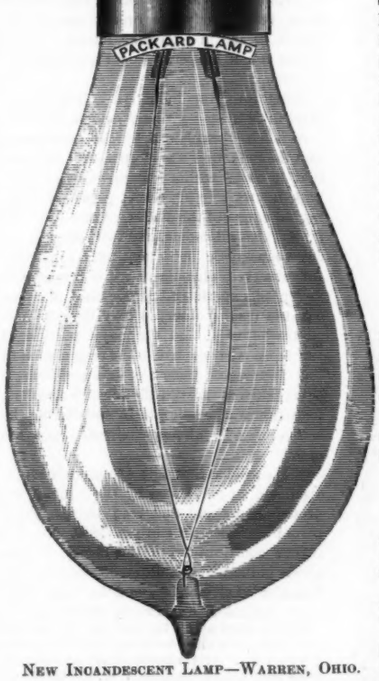
At Seattle, Wash., there is about to be put into operation a novel method of running electric cars up steep grades. The electric railway there has a very steep grade about 800 feet long, and it has been found that the motors on the cars are inadequate to surmount the hill. To correct the difficulty a small conduit about two feet square is constructed, and this is to run a small car as a counter-balance. Two ropes will be attached to the counter-balance car at the top. When an ordinary car is attached to the rope the counter-balance car runs down the hill, but when the car reaches the top of the hill, it runs down on the other side, and, aided by the motor, it pulls up the counter-balance car, which is now ready to bring up another car.

### A New Incandescent Electric Lamp.

We illustrate, herewith, the new Packard high grade incandescent lamp, manufactured by the New York and Ohio Company, at Warren, Ohio. In producing this lamp, the aim of the manufacturers has been to make the best lamp possible, regardless of cost, and this lamp is presented, not as a new or experimental one, but as the perfection and result of seven years' experience in the commercial manufacture of lamps on a large scale.

In all their high volt lamps, 90 volts and upwards, the carbon is supported at the tip by means of an inwardly projecting glass stem carrying a platinum hook. This prevents any drooping or the vibration of the carbon, removing all danger of breakage from these causes, and adding greatly to the symmetrical appearance of the lamp. The low volt lamps, having a shorter carbon, do not need this support and it is omitted. Aside from the intrinsic value of their secret process of manufacture, the workmanship and materials are of the very best, no molded glass or second-hand shells being used.

Although in business but a short time, the




NEW INCANDESCENT LAMP—WARREN, OHIO.

company have an excellently equipped factory, with a large force of experienced hands, and report business very good and their lamps are everywhere giving great satisfaction. The Messrs. Packard, who are at the head of this company, are experienced and able electricians and lamp manufacturers, and deserve the success that their lamp is rapidly winning.

### They Prefer Storage Battery Lighting.

The Pennsylvania Company for Insurance of Lives and Granting Annuities, has ordered from the Electro-Dynamic Company, of Philadelphia, three series of 58 cells, total 174 cells, "15L" type accumulators, with resistance cells, regulating switches, etc., complete, for lighting its building, No. 517 Chestnut street, Philadelphia.

The Pennsylvania Company moved into their new building last Summer, and for five months lighted their offices by means of the direct lighting system, but finally concluded that the storage battery system, which they had in operation in their old building, was the system for them to use.

**Jersey City, N. J.**—The Bergen and Bayonne Electric Company, with a capital stock of $100,000, to manufacture electricity for heating, lighting and power.

### Death of Charles S. Thompson, of Brooklyn.

Charles S. Thompson, the superintendent of the American District Telegraph Company in Brooklyn, died early Tuesday morning, March 17, of apoplexy at his home, 746 Herkimer street, in that city, in his 50th year. He was an expert telegrapher, and had been in the employ of the Brooklyn branch of the American District Telegraph Company since its organization, 19 years ago.

### New York Board of Electrical Control.

The Board of Electrical Control held a meeting in the mayor's office, March 18, and adopted the report of the chief engineer for the construction of subways in the central part of the city, which he offered for consideration last week, and which was laid over for action. His report that all telephone, telegraph, electric light and other wires at present above ground in districts of the city where subways already exist, should be compelled to use the subways before the first of June, was also adopted.

### The Westinghouse Properties.

It was stated that Mr. George Westinghouse, Jr., had been deposed from the presidency of the Westinghouse Air Brake Company, by the action of Mr. A. T. Rowand, in voting the proxies he held as secretary for himself as president at the recent stockholders meeting in Pittsburgh. This is an error. It was the Union Switch and Signal Company, of which Mr. Rowand was secretary, and at the meeting mentioned he was elected president, but on the return of Mr. Westinghouse to Pittsburgh, Mr. Rowand was deposed and Mr. E. H. Goodman elected president. Mr. Westinghouse is president of the Westinghouse Air Brake Company, which is a very successful and strong company, entirely separate from the Union Switch and Signal Company.

### The Importance of the Vowels.

In a newspaper office, in a small town down East, says *Puck*, a mischievous devil hid all the regular vowels excepting the o's. The editor was equal to the emergency, however. Here are a few extracts from the editorials, paragraphs, etc., in the next issue:

COOLTOWN TROMBONO.

Cooltown, Conn.

"Wo rogrot thot owong to o loss of orl oor vowols bot *o*, thot tho Cooltown *Trombono* most moko shoft to do witho ot tho othors.

"Oor sobscrobors con oxorcose thoor onjonoöto thos wok ond oor noxt copo woll look os ooshoöl."

*Puck* then gives a lengthy extract from the locals, advertisements, etc., of the supposed issue of the country paper referred to, only the vowel "o" being used in all words, and winds up the article with the following specimen:

POÖT'S CORNOR.

Moro hod o lottol lomb,
Ot's floss wos whot os snow;
Ond ovrowhor thot Moro wont
Tho lomb wos sho' to go.

The issue, says *Puck*, was a great success. Unfortunately, however, the subscribers have taken it into their heads to owe (*o*) the editor now.

The new street cars on the People's street car line at Springfield, Ill., are furnished with electric heaters.

The United States Government wants one of the original Morse registers now owned by Mr. Stephen Vail, who asks $10,000 for it. The Congressional bill, providing for the purchase at this price, did not get beyond the National Senate Library Committee, where it was pigeon-holed.

The directors of the Gloversville, N. Y., Electric Company have decided to increase the capital stock of the company from $60,000 to $100,000. It was also resolved that the plant of the company be increased by putting in a 250 horse-power engine in addition to the two engines of 125 horse-power each which the company already have in operation. The building of the company, near the railroad, will be greatly enlarged.

**Norwalk, O.**—The Incandescent Light and Power Company; capital, $5,000.

**Edinburgh, Ind.**—Edinburgh Ice and Light Company; capital, $30,000.

**Janesville, Wis.**—H. A. Doty Light and Power Company; capital, $30,000.

**Denton, Tex.**—Denton Water, Light and Power Company; capital, $50,000.

**Cincinnati, O.**—The Electric Supply and Contracting Company; capital, $5,000.

**Martinsville, Ind.**—Martinsville Electric Light and Power Company; capital, $9,000.

**Detroit, Mich.**—Detroit and Dearborn Street Railway Company; capital, $100,000.

**Clarksdale, Miss.**—Clarksdale Water, Light and Power Company; capital, $100,000.

**Portland, Me.**—Sub-surface Electric Company, to manufacture and deal in electrical apparatus; capital, $2,000,000.

**Watertown, Wis.**—Western Manufacturing Company, to manufacture gas and electric fixtures; capital, $25,000.

**Chicago, Ill.**—United States Street Car Motor Manufacturing Company; capital, $300,000. Incorporators, Wm. B Cunningham, H. H. Kennedy and C. F. Vogel, all of Chicago.

**Bristol, Tenn.**—The Wiley Railway Electric Signal Company, with W. B. Ainsworth, president; W. F. Rhea, vice-president, and J. A. Dickey, secretary; to manufacture the patent electric railway signal of E. C. Wiley.

**Chicago, Ill.**—Universal Electric Manufacturing Company, to patent, make and deal in all kinds of electrical inventions, machinery, etc.; capital stock, $20,000. Incorporators, H. M. Day, J. Elliott and J. Usler.

**Jersey City, N. J.**—The Moffett, Hodgkins and Clarke Company, consisting of John F. Moffett, H. C. Hodgkins, John V. Clarke, Charles T. Moffett and Emil C. A. Woltmann, with a capital stock of $500,000, to build and construct water works, railroads, sewers, electric light plants, etc.

**Chicago, Ill.**—The Davy Electric Suspension Company, to build and operate a system of suspended carriages for the transportation of freight and passengers under the J. W. Davy letters patent; capital, $10,000,000. Incorporators, George W. Cole, J. W. Davy, W. W. Shrader and L. A. Bryan.

**Chicago, Ill.**—Electric Bulletin Company, to manufacture, sell, lease and operate railway train annunciators and devices for advertising purposes, and to do a general manufacturing and advertising business; capital stock, $50,000. Incorporators, Franklin A. Jennings, George A. Cross and Paul R. Jennings.

**Milford, N. H.**—The Gouhegan Electric Light and Power Company, with a capital stock of $60,000. The officers are: President, Theodore P. Dresser; secretary, Geo. A. Beatty; treasurer, W. A. Clark, Jr.; general superintendent, C. E. Pendleton; directors, T. P. Dresser, G. A. Beatty, C. E. Pendleton and W. A. Clark, Jr.

**Oakland, Cal.**—Central Avenue Railroad Company; capital, $1,000,000. The directors are: Marcus H. Grossmayer, Oakland; Walter F. Beck, Oakland; Edward Pollitz, San Francisco; Theodore Wagner, Orinda Park, Contra Costa county; John F. English, San Francisco. The officers are: Edward Pollitz, president; H. J. Lusk, secretary; the London, Paris and American Bank, Limited, treasurers.

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NEW YORK, MARCH 28, 1891.

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Cross talk on the recently opened London-Paris telephone line may create a new and unlovely *patois.*

A complete and carefully prepared index to Volume XVII of the ELECTRICAL REVIEW is mailed with this issue.

In homely and ungrammatical phrase, the *Courier*, of Lincoln, Ill., has set the following pearls of wisdom: "You people who have money to invest in city property had better do so at once. When the electric light company complete their line; when the Orphans' Home is completed, the collar factory stands as a monument to enterprise and property is ten times as active as now, you will wish you took our advice and invested."

An English paper devoted to the interests of British trade with South America is grumbling because the Central and South American Telegraph Company has extended its lines south from Lima to Valparaiso, in competition with the cables of the West Coast of America Telegraph Company. The West Coast Company laid cables between Lima and Valparaiso in 1876 and then rested on its oars. It might have continued its lines up the coast to Mexico and so establish direct communication between North and South America; but the opportunity lying at its doors was neglected, and the Central and South American Company, an American corporation, did the work in 1882. Now the latter company has carried the war into Africa and has just extended its cables southward to Valparaiso, and rumor has it that the company is also negotiating the purchase of the Transandine telegraph line between Chili and the Argentine Republic. This steady extension of a profitable system is characteristic of American management, and it seems to us that the West Coast Company has nobody but itself to blame for its unfortunate position. It was first on the field and had the opportunities to extend operations and secure itself from competition, besides creating a more valuable traffic than its limited system could cater to. The opportunities were neglected and have been taken advantage of by others; therefore, there is little to be gained by repining, publicly or otherwise.

## *TELEPHONE INDUCTION.*

In another part of this issue we print a paper, entitled "Inductive Disturbances in Telephone Circuits," read by Mr. J. J. Carty at the last meeting of the American Institute of Electrical Engineers. In this paper are described and illustrated some original experiments devised by Mr. Carty, which show very clearly the precise manner in which silence in telephone lines is secured by the use of properly constructed metallic circuits.

Heretofore, the inductive action taking place in twisted and transposed metallic circuits has been explained by the assumption that the induction was electro-magnetic, and that it came within the province of well-known laws. In his recent paper, and during the course of the discussion that followed it, Mr. Carty demonstrated that the laws of electro-magnetic induction fail to account for observed phenomena; his remarkable group of experiments prove that in every case the results observed may be explained electrostatically, and the major portion of the paper was devoted to the enunciation of the electrostatic theory of transpositions, it being taken as proved that electro-magnetic induction was negligible in considering the action of one telephone circuit upon another.

We consider that this assumption is unassailable when viewed by the light of the present paper and that read by Mr. Carty before the Electric Club in 1889. In this earlier contribution to the theory of telephone induction, the difference between the behavior of electrostatic and the electro-magnetic induction was clearly set forth.

At the meeting of the Institute it was, at first, not quite clear to many of those present that Mr. Carty's paper dealt exclusively with telephone induction, *i. e.*, the action of one telephone circuit upon another, and in the discussion the author showed, by the description of a few decisive experiments, that with the most powerful form of transmitter in use at present, it is impossible to create a magnetic field around a telephone wire of sufficient strength to produce currents in a neighboring wire capable of affecting the receivers connected to it. Of course, these experiments may be found only to hold good with the transmitters in use to-day. If more powerful transmitters are devised, electro-magnetic induction will, no doubt, then be introduced.

We think that telephone men the world over will appreciate the value of Mr. Carty's contributions to the theory of the telephonic art, and none of them can fail to obtain a comprehensive grasp of the vexed (and vexing) question of telephone induction by careful study of the clear and straightforward methods by which the conclusions summarized above are arrived at.

## *DIRECTION OF DYNAMO CURRENTS.*

The following rhyme will prove serviceable in determining the direction of flow of current in generator coils, *if remembered:*

If we thread a coil with a line of force,
And look through the coil at the Boreal source,
The current induced will flow clock-wise.

If the coil should tilt and the thread slip out,
The current will follow an opposite route,
I. E. to the clock contrary-wise.

[The poet requests us to mention that "Boreal source" is a figure of speech for north pole of the magnetic system.—ED. REVIEW.]

## *INTERNATIONAL TELEPHONY.*

In another place we publish an interesting article by Mr. Herbert Laws Webb on the London-Paris telephone line, which will command the attention of telephone men all over the country. The inauguration of telephonic communication between London and Paris marks an era in the history of telephony and the description of the line and its electrical conditions so clearly set forth in the article referred to, constitute a valuable contribution to the current literature of electrical progress.

In his article Mr. Webb summarizes the history of international telephony, devoting some attention to the electrical conditions of the line between Buenos Ayres and Montevideo, and showing, *en passant*, that the K R of this line has hitherto been incorrectly stated and is actually less than half the number (10,400) that has gained currency. An interesting comparison is thus afforded between the South American line and that which unites London and Paris, of which having received information by cable from Mr. Preece, Mr. Webb is able to give full particulars as to the various features of construction and the actual working conditions obtained.

Last week we reproduced a short article from our London namesake in which misgivings were expressed as to the commercial success of the line, but we think such misgivings are altogether unfounded. We feel little doubt but that the line will be as unqualified a success financially as Mr. Webb shows it to be electrically. Long distance telephony makes its own business very rapidly. The journey from London to Paris occupies more than eight hours and is often a very unpleasant journey to make. Many business transactions that cannot be concluded by sheafs of telegrams, can be easily settled by a conversation over the telephone. In the absence of the telephone, a journey by one party to the transaction or the other would be necessary, but the telephone brings them together with the minimum expenditure of time and labor. This immense boon secured to business men by long distance telephony is overlooked by our English contemporaries, because they have had as yet but little experience with telephony between great centers many hours apart, but in this country it is held to be one of the most important features in long-distance service. We have no doubt that it will be promptly appreciated by the business men of London and Paris.

## *AFTER THE SUBSCRIBERS AGAIN.*

The lower-telephone-rate confidence game is in active operation in this city. It came with the return of "la grippe." When Barnum said "The American public likes to be humbugged," he included New Yorkers, who are generally conceded to be a little in advance of the average American in astuteness and shrewdness. Nevertheless they are giving up their good round dollars to a crowd of unknown canvassers for the avowed purpose of corrupting the legislators, which by their own votes they have sent to Albany to transact the business of the State in an honest fashion.

We venture to say that the business firms of this city who really understand the value of telephone service are not among these victimized subscribers.

We have the same feeling of sympathy for the men who have given money to these canvassers as we have for a man from Philadelphia who will go over on the Bowery and give up his wealth for the pleasure of telling a young man under which shell the little ball isn't.

The New York Board of Trade Telephone Committee has "decided to assess" the 7,000 telephone subscribers of this city two dollars each for the same purposes as the canvassers. This action partakes of the nature of a jest. A jest is ruined by serious treatment. Let us laugh with the 7,000 and congratulate ourselves that the so-called Board of Trade didn't "decide to collect."

# CORRESPONDENCE.

## OUR CHICAGO LETTER.

**G. W. Allison** has been appointed city salesman for Geo. Cutter. Mr. Allison is a former Philadelphian.

**The Electrical Supply Company** have to report recent large orders for their famous Shield brand feeder wire.

**Mr. J. H. Mason**, secretary of the Simplex Electrical Company, of Boston, spent some days in Chicago this week.

**Mr. H. T. Paiste**, manager of the famous Paiste porcelain base switches, was in Chicago on business this week.

**Mr. W. H. McKinlock**, president Central Electric Company, has just returned from a short business trip in the East.

**The Standard Oil Filter Company** are very busy manufacturing the celebrated Ellis oil filter to supply the ever increasing demand.

**Mr. F. S. Terry**, general manager of the Electrical Supply Company, has returned to the Chicago house after playing the combination of business and pleasure for some weeks in the East.

**The Sunbeam Incandescent Lamp Company**, becoming familiarly known as the S. I. L., are compelled to work to the utmost capacity of their large factory to supply the enormous demand for their lamps.

**Capt. W. L. Candee**, manager of the Okonite Company, spent some days in Chicago this week. It is to be hoped he escapes the grippe, but I have my fears, as the electrical people are not escaping by any means.

**The McGuire Manufacturing Company**, electric motor truck manufacturers, Chicago, report recent sales of their trucks to over 15 electric railway companies; this includes increase in equipment and original orders.

**Mr. Thos. G. Greis** is to be congratulated upon the publication in the London *Electrical Review* of his paper, entitled, "Commercial Rotary of Electrical Generators," which was read before the Chicago Electric Club, January 19, 1891.

**Mr. J. C. Reid**, vice-president Tramway Rail Company, of Pittsburgh, spent a few days in Chicago this week, making his headquarters at the office of the Electric Merchandise Company, who are the Western selling agents for his company.

**The Machinery** is just about in position in the new shops of Mr. Geo. Cutter, and we may soon expect to see all his good ideas in the material. The new branch porcelain cut-out, which has been, for certain reasons, termed "Cutter's baby," is having a ready sale.

**The New Temple** of the W. C. T. U., corner of La Salle and Monroe streets, which will be one of the largest office buildings, and by far the most handsome, will be wired and lighted throughout by the Western Electric Company, of Chicago and New York.

**The Excelsior Company**, through its Chicago office, have recently sold the following arc light plants, all the new type Hochhausen machine: Fostoria, Ohio, 75 lights; Findlay, Ohio, 50 lights; Macon, Mo., 50 lights, and also a 50 light plant at Steven's Point, Wis., which is not yet completed.

**The Electric Engineering and Supply Company**, of St. Paul, Minn., have established a branch at Duluth, Minn. Mr. Hardy, formerly of the Northwest Thomson-Houston Company, is in charge. Mr. Richard Ferguson leaves the Englewood Electric Light Company to become identified with the above company.

**Among some** of the recent electric supply orders received by the Electric Merchandise Company is a large order from a firm of electric street railway contractors of Zurich, Switzerland. This is at least complimentary to the World's Fair city, and shows that our friends in foreign countries must know something of Chicago.

**F. L. Merrill**, Western agent for the Consolidated Electric Storage Company, recently appointed, reports prospects bright. Mr. Merrill is also agent for the Loomis system of electric lighting, operated by the Eureka Electric Company, of New York. A new and handsome catalogue has just been gotten out by this company.

**R. B. Watson Electric Company** is the name of a new firm in Detroit. Mr. Watson, who was for several years connected with the Detroit Electrical Works, has resigned his position and formed the above company for the manufacture of electrical goods generally, fine brass goods and the Cosmopolitan electric battery.

**What has Proved** indeed an attraction was the placing of a very handsome two horse-power Eddy motor in the show window of a popular shoe store of the city, located in the Palmer House. Mr. Kohler, agent of the Eddy Motor Company, has the credit of causing some little excitement in the city this week. The motor is driving a shoe machine and attracts large crowds.

**Mr. J. A. Hornsbury**, the recently appointed secretary to Prof. J. P. Barrett, of the Bureau of Electricity of the World's Columbian Exhibition, besides being an affable and genial gentleman, is an out and out newspaper man and bids the boys a royal welcome, especially the representatives of the electrical journals. Mr. Hornsbury expects to send out this week about 3,000 copies of the Classifications of the Electrical Exhibits for the Fair.

**The Chicago and Eastern Illinois Railway** have recently fitted out and commenced running handsome vestibuled trains between Nashville, Tenn., and Chicago. The train is called the Chicago and Nashville Limited. The National Electric Headlight Company, of Indianapolis, have installed upon the locomotives of these trains their celebrated arc headlights. A small dynamo and engine is placed just behind the large lantern shell which contains a complete arc lamp which gives a much preferable light to the old style of oil lamp. L. W. C.

Chicago, March 21.

## OUR BOSTON LETTER.

**The Edison Electric Mining Company**, this city, has declared a semi-annual cash dividend of three per cent., payable April 1.

**The Erie Telephone Company** report that its sub-companies made a net gain of 71 subscribers in January and 80 subscribers in February.

**Prof. Elihu Thomson** will, at an early day, deliver a lecture in Odd Fellows' Hall, this city, in aid of the Electric Mutual Benefit Association.

**The Commercial Cable Company** has declared a quarterly dividend of 1¾ per cent., payable on April 1, to stockholders of record March 21.

**The Thomson-Houston International Electric Company** has declared a dividend of $3.50 per share, payable April 15, to stockholders of record April 1.

**Mr. E. T. Le Prohon**, of Montreal, Canada, for several years past prominently identified with Canadian electrical enterprises, was in the city for a few days this week.

**Telephone Employees Ball.**—The first grand ball to be given by the New England Telephone Company's employés will take place at Odd Fellows' Hall, Boston, April 15.

**Mr. Geo. W. Mansfield**, of the electric railway department Thomson-Houston Electric Company, is announced to read a paper on "Electric Propulsion" before the Society of Arts, Massachusetts Institute of Technology, Boston, March 26, at 8 P. M.

**Mr. Ferdinand A. Hart**, formerly connected with the Thomson-Houston Electric Company in the capacity of sales agent for Central New York, is now the junior member of the firm of Messrs. Chester & Hart, this city, general agents of Ætna Life Insurance Company.

**The American Projectile Company's** new factory building in West Lynn, Mass., is rapidly nearing completion under the personal supervision of Lieut. W. M. Wood, of the U. S. Navy. The walls are up, the windows being put in the monitor roof, and the floor beams, which will be filled in with concrete, being laid. The brick foundations are being put in for an accumulator and a press, and a heavy steam hammer is already in position. It is thought the building will be all ready for occupancy in the required 60 days. W. I. B.

Boston, Mass., March 21.

## FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, March 21, 1891. New York, Boston and Washington Stock Exchanges. Pittsburgh closing March 20.

| | |
|---|---|
| **NEW YORK.** | |
| Western Union Telegraph Co. | 79¼ |
| American Telegraph & Cable | 81 |
| Central and South American | |
| Mexican | |
| Commercial Cable Co. | 104 |
| Postal Telegraph Cable | |
| Edison General Electric Co. | 100 |
| " " " Deferred | |
| Consolidated Electric Light | |
| Edison Electric Illuminating Co. | |
| United States Electric Light | |
| North American Phonograph | |
| **BOSTON.** | |
| Thomson-Houston Electric Co. | 43¼ |
| " " " Preferred | 25¾ |
| " " " Series C | *9¼ |
| " " " Series D | 6½ |
| " " International Co. | |
| " Welding Co. | |
| " European Welding Co. | |
| Ft. Wayne Electric Co | 12¼ |
| TELEPHONE: | |
| American Bell | |
| Erie | 48¼ |
| New England | 50 |
| Mexican | .85 |
| Tropical American | .70 |
| MISCELLANEOUS: | |
| Edison Phonograph Doll | |
| **WASHINGTON.** | |
| Pennsylvania Telephone | 25 |
| Chesapeake and Potomac | 57¼ |
| American Graphophone | 5¾ |
| United States Electric Light (Washington) | 170 |
| Eckington and Soldiers' Home Electric Railway | 56¼ |
| Georgetown and Tennallytown | 60 |
| **PITTSBURGH.** | |
| Westinghouse Electric Mfg. Co. | 11¾ |

*Ex. Dividend.

## ELECTRICAL CLASSIFICATION.

FOR THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, 1893.

The Exposition Classification, so far as the electrical department is concerned, has been overhauled and entirely recast. When the general classification was adopted by the Commission, several months ago, the power to make any needed changes in it was vested in the director-general, who has exercised that power by approving and adopting an entirely new classification of the electrical department, elaborated and submitted by its chief, Prof. Barrett. In a few days 3,000 copies of the new classification will be printed and forwarded to all the prominent electricians in the country.

The reasons for reforming this classification were numerous. Prof. Barrett, in his formal request to Director-General Davis for this change, compliments the original classification, considered from a scientific point of view, but represented that for practical purposes it would never do. For instance, it creates a class of "Magnetic Electricity;" but electricians agree that this title is now obsolete, and that what is meant by it is properly described as "permanent and temporary magnets;" and a change has been made accordingly. Again, there are many applications of electricity which have no place in an electrical exhibit. For instance, the original classification contains a class of "Electric Forging." But there is, so far as Prof. Barrett knows, no such thing as electric forging. An electric motor is sometimes the driving power in forging operations; but a windmill or a water wheel would answer the same purpose. On the other hand, long-distance telephony, which is a distinct class of telephony, was entirely omitted in the original classification.

It also omitted a class for electro-medical exhibits, such as those for the diagnosis of disease, though these instruments have now become a very prominent class. Professor Barrett has also created a new group, consisting of patent office models in this and other countries, and is already far advanced in his efforts to make this exhibit a brilliant one. Congressman Durborow, the representative of the electrical fraternity in Congress, has been asked to consult with the patent officials at Washington, and a way will shortly be found for reaching those of Europe. The electrical department is the first to secure a change in its classification, but it is said that it will not be the last, and that several other departments will ask for similar changes before long. The following is the new electrical department classification:

DEPARTMENT "J"—ELECTRICITY.

GROUP 119.

APPARATUS TO ILLUSTRATE THE PHENOMENA AND LAWS OF ELECTRICITY AND MAGNETISM.

Class 718.—Statical electricity.
Class 719.—Thermo electricity, thermo electric batteries.
Class 720.—Magnets, temporary and permanent.
Class 721.—Induction coils, converters, etc.

GROUP 120.

APPARATUS FOR ELECTRICAL MEASUREMENTS.

Class 722.—Standard resistance coils.
Class 723.—Standard condensers.
Class 724.—Standard batteries.
Class 725.—Instruments of precision, voltmeters, ammeters, wattmeters, etc.

GROUP 121.

ELECTRIC BATTERIES, PRIMARY AND SECONDARY.

GROUP 122.

MACHINES AND APPLIANCES FOR PRODUCING ELECTRICAL CURRENTS BY MECHANICAL POWER—DYNAMICAL ELECTRICITY.

Class 726.—Dynamos of direct constant E. M. F., varying current.
Class 727.—Dynamos of direct constant current and varying E. M. F.
Class 728.—Dynamos of alternating current, constant E. M. F. and varying current.
Class 729.—Dynamos of alternating constant current and varying E. M. F.

GROUP 123.

COMMERCIAL TRANSMISSION AND REGULATION OF THE ELECTRICAL CURRENT.

Class 730.—Cables, wires and insulation, rheostats, switches, indicators, registering meters, ammeters, voltmeters.
Class 731.—Safety and protective appliances, lightning rods, lightning arresters, insulators, fusible cut-outs, safety switches, etc.
Class 732.—Conduits, interior and underground.

GROUP 124.

ELECTRIC MOTORS.

Class 733.—Direct constant current.
Class 734.—Direct constant E. M. F.
Class 735.—Alternating current.

GROUP 124 "A."

APPLICATION OF ELECTRIC MOTORS.

Class 736.—Street, underground, mining and other railways.
Class 737.—Elevators, pumps, printing presses and general machinery.
Class 738.—Toys, novelties and domestic appliances.

GROUP 125.

LIGHTING BY ELECTRICITY.

Class 739.—The arc systems, their lamps, fixtures and appliances.
Class 740.—The incandescent systems, their lamps, fixtures and appliances.

GROUP 125 "A."

HEATING BY ELECTRICITY.

Class 741.—For warming and heating apartments.
Class 742.—For heating flat-irons, soldering irons and other objects used in industrial operations.
Class 743.—Maintenance of constant high temperature in ovens.
Class 744.—Electric furnaces.

GROUP 126.

ELECTRO METALLURGY AND ELECTRO CHEMISTRY.

Class 745.—Electrotyping.
Class 746.—Electroplating, gilding and nickeling.
Class 747.—Electro deposition of iron and other metals.
Class 748.—Electrolytic separation of metals from their ores or alloys.

GROUP 127.

ELECTRIC WELDING, STAMPING, TEMPERING, BRAZING, ETC.

Class 749 "A."—Apparatus for and methods of welding or joining iron, steel and other metals.
Class 749 "B."—Brazing, stamping, tempering, etc.

GROUP 128.

ELECTRIC TELEGRAPH AND ELECTRIC SIGNALS.

Class 750.—Various systems of transmitting and receiving.
Class 751.—Chronographs.
Class 752.—Annunciators.
Class 753.—Thermostats.
Class 754.—Fire alarm apparatus.
Class 755.—Police telegraph and burglar alarm apparatus.
Class 756.—Railroad signal apparatus.

GROUP 129.

THE TELEPHONE AND ITS APPLIANCES.

Class 757 "A."—Cables: Construction and underground work.
Class 757 "B."—Special protective devices.
Class 757 "C."—Switchboards.
Class 757 "D."—Transmitting apparatus.
Class 757 "E."—Receiving apparatus.
Class 757 "F."—Signaling apparatus.
Class 757 "G."—Long distance systems.
Class 757 "H."—Various systems of operation.
Class 757 "I."—Subscribers' apparatus: Numbers, code, registers, etc.

GROUP 130.

THE PHONOGRAPH.

Class 758.—Receiving and recording apparatus.
Class 759.—Apparatus for the reproduction of recorded sounds and articulate speech.

GROUP 131.

ELECTRICITY IN SURGERY AND THERAPEUTICS.

Class 760.—Cautery apparatus.
Class 761.—Apparatus for the application of the electrical current as a remedial agent.
Class 762.—Apparatus for diagnosis.
Class 763.—Apparatus for the destruction of life.

GROUP 132.

APPLICATIONS OF ELECTRICITY IN VARIOUS WAYS NOT BEFORE SPECIFIED.

Class 764.—Ignition of explosives; gas lighting, etc.
Class 765.—Control of heating apparatus by electricity, as applied to steam and hot air pipes and registers.
Class 766.—Electric pens.
Class 767.—Application in photography.

GROUP 133.

HISTORY AND STATISTICS OF ELECTRICAL INVENTION.

Class 768 "A."—Objects illustrating the development of the knowledge of electricity and of the application of electricity in the arts.
Class 768 "B."—Collections of books and publications upon electricity and its applications.

GROUP 134.

PROGRESS AND DEVELOPMENT IN ELECTRICAL SCIENCE AND CONSTRUCTION AS ILLUSTRATED BY PATENT MODELS OF VARIOUS COUNTRIES.

Class 769 "A."—United States Patent Office exhibit of electrical models.
Class 769 "B."—Foreign patent office exhibits of electrical models.

Chicago, March 17. L. W. COLLINS.

# Telephonic News

*** Aransas Pass, Texas, has granted a permit for the establishment of a telephone exchange.

*** The Wisconsin Senate last week passed a bill requiring telephone companies to pay an annual license fee of 2¼ per cent. on their gross earnings.

*** The Ansonia Brass and Copper Company, 19 to 21 Cliff street, New York, have issued a little pamphlet called "Tobin Bronze." Many facts of interest to intending purchasers are given about this valuable metal.

*** The telephone line between London and Paris was opened Tuesday, and proved "a royal success." Now let the French President connect with Emperor William and turn on some three-cornered diplomatic fun.—*Boston Globe.*

*** The Pennsylvania Telephone Company has sent out notices of an increase of five cents in rates for talking between the Bethlehem, Easton and Allentown, and the notice states that "the demand for better and increased facilities for communication among our subscribers at Allentown, Bethlehem and Easton, will soon be satisfied by the replacement of the old iron grounded circuits with new copper metallic circuits, upon the completion of which the charges for a conversation of five minutes or fraction thereof will be: Between Allentown and Bethlehem, 10 cents; Bethlehem and Easton, 15 cents; Allentown and Easton, 25 cents.

*** Mr. James H. Howard, general manager of the Tropical American Telephone Company, Limited, of Boston, thinks no better illustration can be found of the result to be expected in the United States upon the expiration in 1893 of the Bell telephone and Blake transmitter patents, than the present state of affairs in Canada, where the Bell patent is inoperative by reason of adverse judicial decision. The rates charged by the Bell Telephone Company is $25 per year for resident or business houses. The opposition company, the Federal Telephone Company, charges $35 per year for business houses and $25 for residences. Both companies are said to be adding new subscribers to their systems at the rate of about 100 a month, the Bell Telephone Company having about 5,000 subscribers in the city alone, and the Federal Telephone Company about 6,500 subscribers. Both companies use the same form of instruments, the Bell and Blake receiver and transmitter, identical with those used in the United States.

### Telephone Subscribers Swindled.

Telephone subscribers in New York city are being bored by the agents of a man of the name of Hon. A. Worth Spates. Who he is, or whether he knows his name is being used or not, is unknown. Many business men who are telephone subscribers are asked to sign the following:

The subscribers hereby promise and agree, each for himself, to pay to the Hon. A. Worth Spates, and those who may be associated with him, the sum of $20, as compensation in full, for all services and expenses to be incurred in procuring the passage of an act by the General Assembly of New York, regulating and limiting the charges for telephone service in the State so that the cost for each instrument shall not exceed $60 per annum—one-fourth of this subscription to be paid as soon as 100 subscribers to this agreement shall have been obtained, and the balance when the act shall be passed by both houses of the legislature and receive the approval of the governor. In no case is the subscription to be paid to other than the collector.

One collector last Saturday had secured 125 names and $625. At this rate somebody is making about a million a minute. The intelligent collector told some experienced telephone subscribers that all the subscribers in New York were on *one* line, and gave out off-hand a great deal of other valuable electrical knowledge. It remains to be seen how many business men of this State will assist in a scheme of this nature.

The Telephone Committee of the Board of Trade and Transportation decided last week also to take a hand in telephone legislation. They decided to dock the 7,000 telephone subscribers in this city something like $2 each, and with this $14,000 go to Albany with a special committee and see to it that a bill calling for lower telephone rates is passed.

### Hall's New French Battery.

A battery especially designed for medical use, by Mr. Thomas Hall, 19 Bromfield street, Boston, is shown in the accompanying illustration. It is a bichromate of potash battery, thoroughly made in all its parts. Special patented conducting cords, five feet long, are used, and many of the metal parts are silver-plated. This battery seems to fill a want, and is meeting with ready and increasing sales.

HALL'S NEW FRENCH BATTERY.

### Automatic Lamp Lighter.

Mr. Shelford Bidwell describes a practical use for selenium cells in a recent number of *Nature*. The fall of evening automatically lights a lamp by causing a change of resistance in a selenium cell and operating a relay controlled by a local battery. The apparatus is diagrammatically shown in the accompanying engraving.

It will be seen that therearethree circuits. The first includes a battery, A, of 24 small Leclanche cells, the selenium cell, H, and the magnet coils of the relay, R, and also a galvanometer, G. In the second circuit is a Leclanche cell, B, one pole of which is connected through the terminal, T, with the tongue of the relay, R, and the other through the magnet coils of the electro-magnetic switch, K, and the terminal, S, with one of the platinum stops of the relay. The third circuit contains the lamp battery, C, the incandescent lamp, L, and the tongue and stop of the electro-magnetic switch, K. The three simple switches, X, Y, Z, are useful for breaking any of the circuits.

LAMP LIGHTING SYSTEM.

The selenium cell, H, has a resistance in the dark of about 50,000 ohms, which is diminished to one-half, or less, by the action of diffused daylight, or by the light of an ordinary gas-jet at a distance of one foot. The relay, R, is a "standard relay," as used in the Postal Telegraph service. Its tongue, connected, with the terminal, T, oscillates between two adjustable stops, which are connected, respectively, with S and M. The electro-magnetic switch, K, is simply an ordinary electric bell relay; it is used in order to avoid passing a strong current through the delicate relay, R. The lamp, L, is an 8-volt lamp of five candle-power. The battery, C, consists of five bichromate or Grove cells.

The connections being made as above, the relay is adjusted so as to make the tongue press against the M stop, and then (the selenium cell being in the dark or only feebly illuminated) it is adjusted until the tongue passes over to the S stop, which causes the lamp to be switched on. If, now, the selenium cell is exposed to a sufficiently strong light, the tongue moves back to the M stop, owing to the increased current through the magnet coils, and the lamp goes out. It is possible to adjust the relay so that the lamp is lighted automatically whenever the external illumination falls below any desired degree of intensity, and the adjustment, when once properly effected, will remain perfect for days or weeks together.

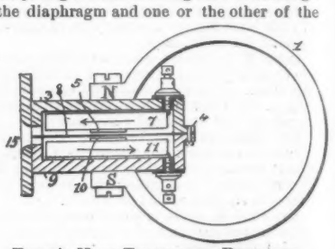
The selenium cell is made by winding two fine copper wires, which serve as electrodes, very close together around a slip of mica, one surface of which is afterwards coated with a thin film of selenium. The cell used for the lamp experiment measures 2½ inches by ¾ inch; the gauge of the copper wires is No. 36, and each wire makes 20 turns to the inch. The resistance of the cell in the dark is about 52,000 ohms.

The experiment may be shown by placing the cell near a window and closing the shutters, when the lamp immediately lights up, going out again as soon as the shutters are re-opened. When daylight is not available, the effect may be exhibited in a scarcely less striking way by alternately screening and exposing a gas burner placed at a distance of a foot or two from the selenium, or by turning the gas up and down. The following test illustrates the sensitiveness of the arrangement: The relay was adjusted so that the lamp circuit was just closed when a standard candle was burning at a distance of 7½ inches from the selenium cell. The candle was moved slowly towards the cell, until the distance between them was reduced to 6½ inches, when the increased illumination caused the lamp circuit to be broken. The candle was then moved back, and when the distance was once more 7½ inches, the circuit was again closed. By moving the candle backwards and forwards over a range of about one inch, the circuit could be alternately closed and broken as often as desired. The extreme difference in the strength of the currents passing through the selenium under these changes of illumination was shown by the galvanometer to be rather less than 0.1 milliampere.

Dr. G. P. Hachenberg, of Austin, Texas, has a number of electrical schemes of considerable merit for the Columbian Exposition.

### Field's Sensitive Telephone.

In the accompanying engraving is illustrated a sensitive telephone, of very ingenious construction, invented by Mr. Stephen D. Field. A ring magnet 1 forms the handle of the telephone and between the poles is supported an iron box, the two sides of which have opposing cheeks or pole-pieces of soft iron within the box, between which cheeks is supported the diaphragm. The lines of force of the permanent magnet are thus at all times on closed circuit through the iron box. The coils of the spools which are connected to line are oppositely wound, as indicated by the arrows. The diaphragm is thus supported, as it were, in a magnetic bridge. By reason of the complete magnetic circuit formed by the box, but few lines of force will normally pass through the soft iron poles 9, 10, and the diaphragm will be free from stress toward either pole; but if a current passes over line it will tend to oppose the lines of force flowing through one part of the box, and shunt them through the diaphragm which lies in a magnetic shunt of high resistance around a normal magnetic short circuit, the lines of force on the passage of current being deflected through the diaphragm and one or the other of the




FIELD'S NEW TELEPHONE RECEIVER.

cores 5, 10. Several important advantages result from this construction. The diaphragm is normally uncontrolled and free to respond fully and instantly to the most subtle currents, and by reason of this indifference can be set very much nearer the cores than usual, thus, of course, bringing it into a much denser portion of the field and increasing its power. Again the diaphragm being free from normal stress will respond to currents which under ordinary conditions would be wholly inert, and can be made of extreme thinness so as to be highly sensitive without being buckled or distorted by the attraction of the permanent magnet. Again, the vibration of the diaphragm is positive in both directions, and thus each phase of a complete vibration of a diaphragm is the result of an attraction as distinguished from an attraction and a backward spring due to the elasticity of the diaphragm. Inasmuch as the instrument is so sensitive, the resistance of the coils can be made lower than usual. In the form illustrated in the diagram the ear or mouth-piece is placed on the side of the box. Another form of the instrument is illustrated in the patent in which a compound bar magnet is used instead of the ring magnet.

### Opening of the London-Paris Telephone Line.

The inaugural telephone talk between London and Paris by the new land and submarine cable line on March 17 was a notable event. Mme. Roche, wife of M. Roche, Minister of Industry and the Colonies, had the honor of uttering the first words over the new line. M. Roche then held a conversation with Mr. Henry Cecil Raikes, the Postmaster-General of Great Britain. M. Roche said that he hoped the telephone line would form a fresh link of friendship between Great Britain and France. The Earl of Lytton, the British Ambassador at Paris, and M. de Selves, the Director-General of the Posts and Telegraph Department, also spoke to Mr. Raikes by telephone.

La Roche (Phila.) Electric Works has organized with a capital of $100,000. The directors are Alfred I. du Pont, of Wilmington, Del.; Frederick A. La Roche, P. Reinhalter, S. E. Trainer, Gottfried Bender, G. Harry Davis and M. L. Fincker, Philadelphia.

## A Novel Electric Motor.

INVENTION OF MR. RUDOLF EICKEMEYER.

Nearly all electric motors necessarily require a commutator of some form for delivering current in a proper direction in the armature circuit to develop continuous rotation, and such commutators must, in

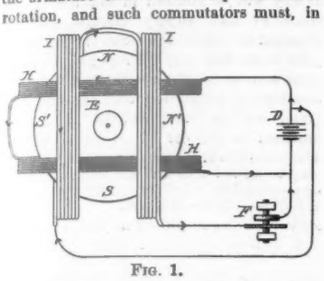


FIG. 1.

order to develop rotation, operate in perfect synchronism with the movement of the rotating element of the motor. Several types of alternating current motors without commutators have been proposed, based upon the principle disclosed by Ferraris, of creating a progressive polar travel in one

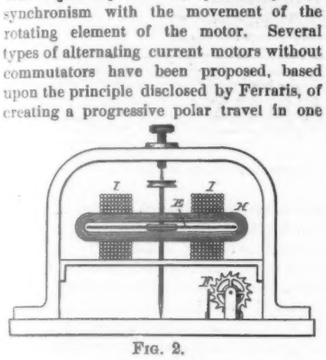


FIG. 2.

element of a motor by two sets of consequent poles developed in an iron ring by two sets of alternating currents in quadrature or a quarter of a phase apart. In motors of this type either two independent alternating currents a quarter of a phase apart must be transferred through the main circuit, or else the phase difference must be created by means of a converter or some other device causing one set of alternating waves to lag behind the others. Under these conditions the magnetism in the ring created by one set of coils is declining in strength, while the other set of coils is tending to create an increasing magnetism at a point in the ring 90 degrees distant. The conjoint effort of the two sets of poles produces a resultant pole which is given a progressive travel around the ring and develops torque upon a closed circuit armature contained within the ring.

A very ingenious and novel motor, also

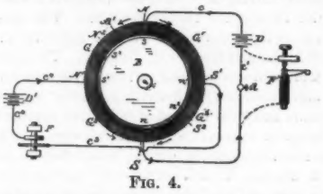


FIG. 4.

without a commutator, has been designed by Mr. Rudolf Eickemeyer, whose name is familiar in the electrical field, in which either direct or alternating currents may be used to develop rotation, the torque being created by a progressive field polar line developed by currents in two sets of field magnet coils, in one of which current may be constant, and in the other of which a pulsatory intermittent current is caused to flow. The principle of the invention may be understood upon an inspection of the accompanying engraving, Figs. 1 and 2, in which is represented an iron disk, E, enclosed within two pairs of coils, H I, placed at right angles to each other; the coils H tend

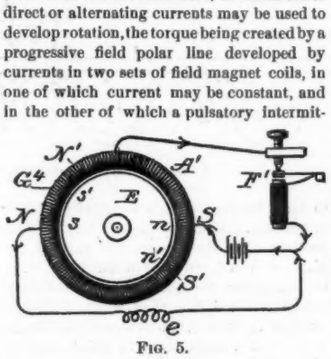
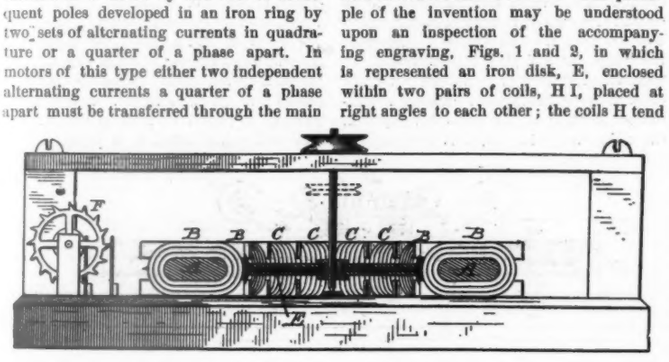


FIG. 5.



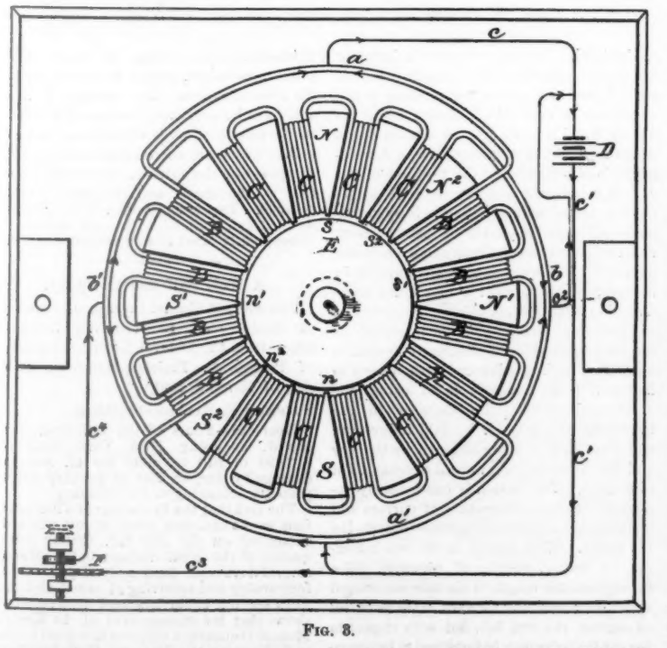


FIG. 3.

to develop a polar line in the disk at the points N S, and the coils I tend to develop a polar line at the points $N^1$ $S^1$, 90 degrees from the first polar line. Assume the coils H to be connected directly to a source of current, as a battery D, and the coils I to be connected to such source through an interrupting device F, which may be a simple star-wheel, an automatic interrupter, or any other convenient contrivance. If, now, the interrupter be put into action, a series of intermittent waves of current will pass through the coils I. The coils H tend to preserve the polar line at N S, and the intermittent impulses tend to create a polar line at $N^1$ $S^1$; when, therefore, an impulse passes through the coils I, a new polar line will be created somewhere between the points N and $N^1$ and S and $S^1$, and with every impulse which passes through the interrupted circuit a distortion or drag of the normal polar line to the right will be created, the line shifting from the instant the interrupter makes contact more and more to the right until the current assumes its full value in the coils I; a rapid interruption in one of the circuits while the other remains continuous, or a rapid interruption of both circuits at successive intervals of time, will, therefore, create a tendency to rotate in the iron disk. Another way of explaining the action would be to imagine a phantom pole intermittingly created in space about the points $N^1$ $S^1$, which set up an attraction when they exist for the poles N S, induced in the armature by the poles N S; every impulse of current in the interrupted circuit, therefore, will exert a pulling effort upon the armature. In Fig. 3 of the engravings the motor is illustrated, as provided with an iron core in its field magnet system, the core being lettered A. The core is shown as wound with 16 coils coupled in two independent groups, four coils of one group being on one side of the core and four on the other side. Current flowing through either circuit would develop a polar line in the core; thus the coils B B would develop a polar line at N S, or the coils C C would develop a polar line at $N^1$ $S^1$. Now, if a source of energy, as D, whether chemical or dynamic, be connected with the wires $a$ $a^1$, current will flow in the direction indicated by the arrows, passing through the two sets of coils B B in multiple arc and developing poles at N and S. If, while this condition exists, the interrupter F, interposed in the circuit between the generator and a branch circuit, including the coils C C, be thrown into action, a tendency will be created each time the interrupter closes the circuit to develop a polar line at $N^1$ $S^1$. Inasmuch as a polar line N S already exists, the pulsatory current controlled by the interrupter will be able only to shift the polar line from N S to some point between N and $N^1$ and S and $S^1$; or, in other words, to drag it to the right. Now, the polar line N S existing before the pulsation of current passed through the interrupted circuit induced poles $s$ and $n$ in the iron disk armature E; when, therefore, the impulse of current drags the polar line of the field to the right, this polar line acting upon the armature will drag the latter with it, and when the impulses are sufficiently rapid a continuous rotary motion is imparted to the armature, the degree of torque increasing with the strength of current. In Fig. 4 the invention is shown as applied to a continuously wound field magnet. In this case two independent generators are shown for the two circuits, one tending to develop a polar line at N S and the other at $N^1$ $S^1$. The current from D passes into the continuous coil in the direction indicated by the arrow, splits and passes down both sides thereof, and returns to the generator. When an impulse from generator $D^1$ is thrown into the coil, the two generators will be opposed in the sections G $G^3$ of the coil, but will be in series in the sections $G^1$ $G^2$, and a resultant pole will be developed at $N^2$ $S^2$, such pole traveling toward these points from the points N S as the magnetism due to the impulse rises in value. It will be observed that in this diagram means are illustrated for affording a pulsatory supply of current to both sets of coils, a binding-post at D permitting an interrupting device $F^1$ to be thrown into circuit by releasing the conductor $c^1$. The vibrator here shown is of the rheotomic or automatic type. Two circuit-breakers such as F might be mounted upon the same rotating shaft, one slightly in advance of the other, so that they may open and close the circuits they control at sequential intervals of time. In the diagram Fig. 5 is illustrated a condition of circuits in which a continuous winding is tapped at three points only, instead of four, as in the diagram last explained. The two poles of the generator are coupled to diametrically opposite convolutions of the magnet coil and one of said poles by way of the interrupter $F^1$ is connected with a convolution substantially equidistant from the other two points of connection, or the three points of connection might be equidistant from each other. When current through the interrupter branch ceases, a polar line is developed at N and S by the continuously flowing current, but when the interrupter closes the circuit, the portion $G^4$ of the coil is neutralized and the poles are thereby shifted to points, say, at $N^1$ $S^1$. In this instance the interrupter branch of the circuit is made of lower resistance than the other by the insertion of a resistance coil at $e$.

.... The electric telegraph was opened to the public in France, March 1, 1851.

.... The Union Pacific Railway Company has issued a circular to all its telegraph operators giving them the option of quitting the road or the Order of Railway Telegraphers at once. There are 800 operators employed on the system.

## PERSONAL.

Prof. Elihu Thomson lectured last week before the members of the Thomson Scientific Club, of Lynn, Mass., on "Energy."

Mr. Hollon C. Spaulding, secretary of the Thomson-Van Depoele Electric Mining Company, Boston, lectured last week before the Fall River, Mass., Board of Trade on "The Commercial Uses of Electricity."

Lieut. F. W. Ellis, officer in charge of the sea-coast telegraph lines, with headquarters in Baltimore, has gone to Washington to appear before the army medical examining board with a view of being placed upon the retired list.

Prof. Elihu Thomson will soon deliver a lecture in Odd Fellows' Hall, in aid of the Electric Mutual Benefit Association, of Lynn, Mass. This organization has a large membership, and is at present assisting 18 members who are on the sick list.

Mr. Arthur Perry, for several years assistant cashier of the Washington National Bank, and treasurer of the Westerly Gas and Electric Light Company, of Westerly, R. I., will soon begin his labors in a new field, having been tendered a call to assume charge of the bond department of the Thomson-Houston Electric Company.

## OUR ST. LOUIS LETTER.

**The Underground Electric Wire Bill** failed to pass in the legislature.

**The Baden & St. Louis & Jefferson Avenue Street Railways** have asked for the right to use electricity on their lines.

**The Emerson Electric Company** report a good demand for their supplies, particularly their own specialties which they have placed on the market.

**The St. Louis & Suburban** have decided to put over $100,000 in an electric system for their line. They have already bought a site for their power plant.

**Mr. Debolt,** of St. Louis, has made arrangements with the National Electric Company for 300 incandescent and 10 arc light plants for the town of Creal Springs, Ill.

**Mr. McKinlock,** of the Southern Electrical Supply Company, reports a brisk business, especially in wire. He has several large equipment orders from Southern points.

**Mr. T. J. Wilson,** of the Western Electrical Supply Company, reports a very good business. He reports the Centralia, Ill., plant as doing very well and with having met with so much business as to require an enlargement. He is at present having an additional boiler placed in the plant.

**The Municipal Company,** Laclede, had a strike of linemen on its hands last week. It was due to the change in the manner of paying the wages. Instead of paying $60 a month, the company decided to pay the men $2.80 a day. This the men objected to. The strike after two days was declared "off" by the company agreeing to pay $2.50 a day in place of $2.30.

**The American Electrical Manufacturing Company** reports a good business, especially in dynamos. This is a new concern, with Mr. Ben. Nahm at its head, as president, with Jos. Wolf, vice-president and Benj. Dubinski, secretary. They manufacture all supplies, dynamos and incandescent lights, besides a long line of specialties. They intend to do all manner of construction work and are prepared to take orders on all specialties.

**One of the Largest Contracts** in the city for wiring was let to the Western Electrical Supply Company. It is for the Cupples building. It calls for 3,000 lights. The rest of the plant was secured by the Edison people. It consists of four No. 12 dynamos. As this company held the contract on dynamos, Mr. T. J. Wilson, president of the Western Electrical Supply Company, turned over to them the contract for the construction work.

March 19, 1891. W. H. B.

* * Thirty days have been added to the time allowed the Lynn, Mass., horse railroad to put in its electric system.

* * The Shaw Electric Crane Company will remove its entire plant and business offices from Milwaukee, Wis., to Muskegon, Mich.

* * The Denverside Street Railway Company, of East St. Louis, Ill., has been granted a franchise to change the motor power to electricity.

* * The franchise drawn up by the City Council and the street car men who propose putting in a street railway in St. Charles, Mo., grants a ten-year privilege.

* * There is a vigorous movement to established an electric railway in Altoona and Hollidaysburg, Penn., and uniting the two places. Its success is thought to be assured.

* * The Electric Street Railway Company, Joliet, Ill., has issued an individual season ticket at $25 which entitles the holder to ride as often as he wishes during the life of the ticket.

* * Action on the granting of a charter by the Rhode Island Legislature to the Fall River Electric Freight Railway, before mentioned, has been deferred until the next session, which assembles in May.

* * The directors of the Pittsfield, Mass., Street Railway have practically completed arrangements for equipping the road with electricity. It is expected that the electric road will be in successful operation by June 1, if not before.

* * W. A. Stadelman, of Philadelphia, and A. H. Leftwich, of Spartansburg, Pa., have purchased the street railway at Bristol, Va., and Tenn. The price paid is said to be $55,000. Electric power will be used on the road.

* * Albany and New York capitalists were in North Adams recently considering the matter of constructing an electric railway to Williamstown, Mass., distance about five miles. It is thought a company to carry out the scheme will soon be organized.

* * The New York State Railroad Commissioners have approved the vote of the stockholders of the Glens Falls and Fort Edward Street Railroad Company, providing for the raising of the capital stock of the corporation from $70,000 to $120,000.

* * The State Board of Railroad Commissioners has approved of the application of the Harlem Bridge, Morrisania and Fordham Railway Company, of New York, for a change of motive power from horses to the overhead single trolley electric railway system.

* * The stockholders of the East St. Louis Electric Railway Company met last week and voted to issue $15,000 of 5-15 bonds bearing six per cent. interest. The main line has already been completed, and has done a paying business since the opening day.

* * At the meeting of the Electric Street Railway Company, Appleton, Wis., last week, a transfer was legally made to the Edison Electric Light Company. The plant will be thoroughly equipped with the Edison system, and about $40,000 will be put into the road, which will be in operation May 1.

* * The Bangor, Me., Electric Railroad Company will have ten motor cars and ten barges running this Summer for the accommodation of the patrons of the road in Bangor and Brewer. The open cars will be placed on the line about the first of May. The number of passengers carried for the year ending 1890 was 646,258.

### Eddy Motor Installation.

A novel motor installation is that made by G. A. Edward Kohler, the Chicago representative of the Eddy Electric Manufacturing Company, at Thomson's restaurant, 145 Dearborn street, Chicago. This consists of a 20 horse-power Eddy incandescent motor running an Excelsior arc dynamo. This installation was made because the engine capacity was not large enough to run both the establishment and the dynamo, and keep the latter at the requisite speed to give a steady light at all times. This appears to be rather an odd and extravagant proceeding, but the economy lies in the fact that the number of arc lights used during the day varies from 4 to 17 in number. The motor being run from the mains of the Chicago Edison Company upon their meter system, rendering it possible to strike an average consumption of power which makes the expense far less than the rental of so many arc lights at so much per day.

The novelty of this feature became apparent to Mr. Kohler after some investigation, and Mr. Cummings, the proprietor of Thomson's restaurant, was easily convinced of the feasibility of the plan. The plant has now been running about six months, and the steadiness of the light has been so great, even when a number were suddenly switched on or off, that the owner of the plant states that under no circumstances would he go back to the old method.

### A Popular Lecture on Electric Motors and their Construction.

Mr. E. H. Cutler, manager of the Elektron Manufacturing Company, Brooklyn, N. Y., delivered a highly interesting address before the electrical department of the Brooklyn Institute, Friday evening of last week. The subject was "Electric Motors and their Construction," and the lecture was of a popular character. Mr. Cutler dealt especially with the slow speed, laminated field type of motor, illustrating his points by practical experiments with a number of the widely known Perrett electric motors set up for the occasion. The lecture was one of the most valuable and instructive of the series, and greatly interested a large audience.

### Sound Aluminum Castings Possible by Using Plumbago Facings.

Sound castings of aluminum can be obtained in dry sand moulds, preferably lined with plumbago. The metal should be heated to a temperature very little above its melting point, and should be poured quickly. The shrinkage of the above metal is $\frac{1}{11}$ inch to the foot (2.26 per cent. of the length of mould).—*Exchange.*

The above statement is not only true as to aluminum, but to all metal castings. Actual sales of plumbago show that barrels of plumbago are now used in shops where pounds were formerly called for. The use of a plumbago facing guarantees to the casting a smooth surface and bright color. Caution is suggested, when purchasing, to obtain exactly the kind wanted for the different work. It can be said of plumbago, as the Irishman said of whiskey, "none is bad, but some is better than others." One kind of plumbago is better applied by the shake-bag, and if the brush is used another kind will prove better. One preparation of plumbago will "sleek," another will not. Another kind is more useful for light castings, another kind for heavier work. Good plumbago will stand the heat and will neither burn nor run before the moulten metal. A wash of plumbago for cores, loam work and dry sand castings is indispensable. The Dixon Crucible Company of Jersey City, N. J., have made a patent study of the subject, and being the only miners of plumbago who afterward prepare it for its many uses, they can give advice on the subject, not elsewhere obtainable. On application, they will send a little book, free and post-paid, that contains more information on the subject of plumbago than is elsewhere in print in any language.

The Eddy Electric Manufacturing Company, of Windsor, Conn., has just closed a contract with the American Encaustic Tiling Company, Limited, of Zanesville, O., for an electric power transmission plant aggregating 365 horse-power. The dynamos will be 90 horse-power each, and the motors will range in size from 10 to 35 horse-power.

## PROGRESSIVE ELECTRICAL INVENTIONS.

ALTERNATING CURRENT TRANSPORTATION SYSTEM.

We illustrate herewith an electric transportation system having for its object the propulsion of vehicles or package carriers over a railway in such a manner that no contacts moving or rolling are required to render the electric energy available. The system is the invention of Messrs. Schuyler S. Wheeler and Charles S. Bradley. The system embraces a fixed railway with one or more stationary alternating current generators and a car formed of inductive material adapted to travel along the railway. On a suitable elevated structure, as represented at 3, are cars 4, each car having attached to it masses of iron 7 side by side, so arranged as to leave between them a longitudinal space or opening. Along the line of way in such position as to lie between the path of the plates of iron 7, only one of which is seen in the engraving, are arranged two undulating inductors 8 and 9, each of which carries an alternating current, the two currents being a quarter of a phase apart in point of time. Upon the passage of current through the conductors a series of shifting poles will be created along the undulating inductors which will act upon the iron masses 7 suspended from the car and give it a movement of translation. One wave is falling while the other is rising in strength, creating a longitudinal shifting of the poles developed in the undulating inductors, thus dragging the car forward. When the current in inductor 8 is at a maximum positive it tends to induce a north pole at a point corresponding to the maximum of upward undulation in the inductor 8 and a south pole at a point corresponding to the maximum downward undulation, and wherever by the position of the car the masses of iron are brought into active relation to the poles which exist in space opposite poles are induced in the mass of iron. Now, as the positive impulse of current in the inductor 8 falls away to zero the impulse in inductor 9 rises toward a maximum negative and creates a north pole about midway of its downward undulation, and inasmuch as the inductor itself is mechanically located in a position slightly advanced with respect to inductor 8, the tendency is to attract the north and south poles induced in the masses of iron 6 and 7 by said inductor 8, and these masses being attached to the car and free to move, a movement of translation is created. This action is continuously repeated with each alternation of current and a constantly accelerating speed is imparted to the motor. With respect to the two inductors, of course, a series of phantom poles throughout the length of the line are created which shift back and forward as the impulses of current rise and fall, but with respect to the car the poles may be imagined to be propagated in the form of a wave from one end of the line to the other. For the purpose of realizing greater power and higher efficiency, the inductors may be associated with a mass or masses of iron forming part of the permanent way, these masses being wound transversely with conductors and connected at intervals with two supply circuits carrying the alternating impulses, as illustrated in the second diagram. The several coils surrounding the mass of iron along the line of way will be coupled in multiple arc relation to their supply circuits, and so arranged as to develop a series of consequent poles in the iron way. Propagation of the polar wave is in all respects similar to that described in connection with the first diagram, and a movement of translation imparted to the car by a similar action. The iron inductive masses carried by the car may be wound with a closed circuit or may be polarized by a battery carried by the car, as indicated in the diagram.

MANUFACTURE OF IODINE BY ELECTROLYSIS.

A method of electrolytically producing

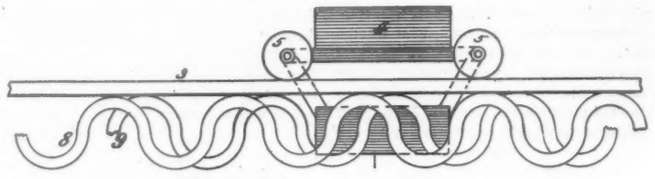


FIG. 1.—WHEELER-BRADLEY TRANSPORTATION SYSTEM.

iodine has been patented by Messrs. Parker and Robinson, of Wolverhampton, England. An acid solution of an iodide of an alkaline earth is prepared, the selection of the best iodide being governed by conditions of local price and solubility in water without decomposition. Iodide of sodium or potassium is the preferred material to be worked with. A solution of a moderate degree of concentration is placed in a suitable electrolyzing vessel, with an anode of carbon and a cathode of iron, and a generator capable of transmitting a current of about two amperes for each square decimeter of the anode is passed through the solution. A porous diaphragm is placed between the electrodes. The acid iodide solution is placed in the compartment containing the anode, and a solution of caustic alkali is placed around the other electrode. The solution is made acid in order to prevent the loss of iodide by the formation of a salt with the oxy acids of iodine, which are not themselves readily decomposed by the current. The iodine is set free at the anode and the alkali at the cathode. The iodine which is produced is drained and washed with cold water and subsequently dried in a current of warm air.

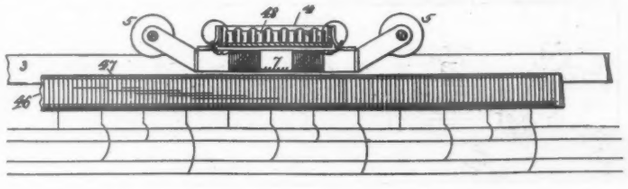


FIG. 2.—WHEELER-BRADLEY TRANSPORTATION SYSTEM.

### A Well Satisfied Company.

The Electric Mutual Insurance Company, of Boston, has received the following letter from the Central Electric Company, of Portage la Prairie, Manitoba, under date of March 2, 1891:

STEPHEN E. BARTON, President.

Dear Sir—Yours of the 24th inst. is received, enclosing New York draft for $189.95 in full payment for all loss and damage by fire, on 25th of January last, to property belonging to our company.

The fact that the fire occurred a little over four weeks ago, that proof of loss was only submitted on the 10th ult., that in consequence of the great distance to be covered, several days must necessarily elapse between forwarding and receiving of same, and that draft for our claim has now been received, shows that the management of the Electric Mutual Insurance Company is in good hands, and deserves the best consideration from every electric company in the Union and Canada. Thanking you on behalf of our company for so prompt settlement,

Yours truly,
(Signed) D. B. HANNA,
Sec. and Treas.

### The Electric Light Plant of the Place Clichy, Paris.

The distribution of electrical energy over an extensive area, writes M. Hospitalier in *La Nature*, involves either the indefinite multiplication of the number of stations or the

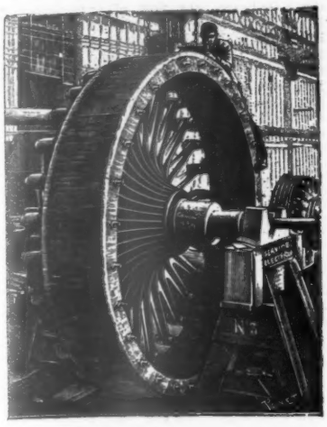


FIG. 1.—CONSTRUCTION OF THE GRAMME RING ARMATURE, 3.3 METRES IN DIAMETER.

employment of high tensions, if we would avoid expensive systems of canalization. The success of distributions by alternating

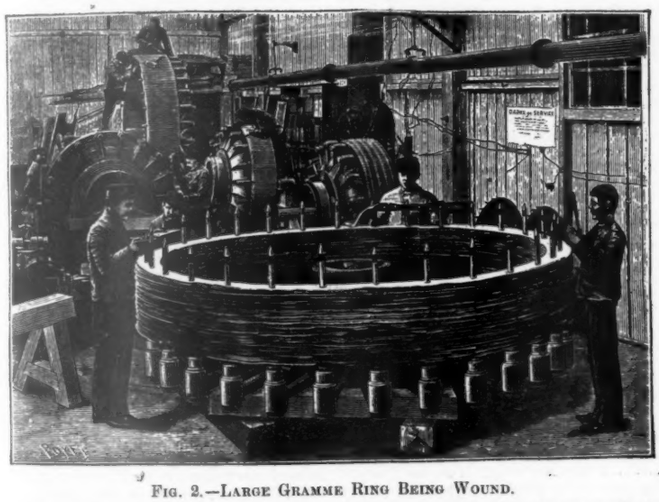


FIG. 2.—LARGE GRAMME RING BEING WOUND.

currents and transformers depends on the facility with which these high tensions can be produced and transformed into low tensions in order to be utilized. Unfortunately, alternating currents involve serious dangers, and, from their very nature, are ill-adapted to applications of motive power, and cannot be employed at all for electro-chemical operations. If to these objections we add the impossibility of storing up energy distributed under the form of alternating currents, we can easily understand why, in the greater number of cases, electricians should hesitate to use these currents, and why so many attempts are made to effect distributions by means of the continuous current, if not at a high tension, at least at an average tension, in order to retain both the advantages of high tensions from an economical point of view and the facilities of employment and storage offered by the continuous current. Among the numerous systems of distribution, having regard to these facts, either proposed or realized during the last few years, that adopted by the company of the sector of the Place Clichy is worth describing somewhat in detail, for it shows once again the varied and, we may say, inexhaustible resources which the electrician has at his disposal for the solution of problems that are apparently most complicated. The problem solved in this case is the following:

Given a general system of canalization supplied by dynamos maintaining between the two conductors of the canalization a difference of potential of 440 volts, to divide this difference of potential into four equal parts of 110 volts each, on which it will be possible to establish utilizing apparatus that can be varied at will either in number or in power, without affecting the working of the other apparatus connected with the system.

It is, moreover, possible to connect apparatus working at differences of potential higher than 110 volts, and thus to obtain a distribution at several potentials, although the central station may only furnish one. This advantage will be highly appreciated when we have to establish motors of a mechanical power exceeding 10 kilowatts. These can then be installed on a difference of potential of 220 volts, electrical tramways with overhead or underground conductors being, on the contrary, supplied by the total difference of potential of 440 volts, economy always being kept in view throughout the system by employing, in each case, the highest potentials compatible with the good working of the receivers or other apparatus used. In order to understand the economy of this arrangement, we must examine in turn the central station, the canalization, the distribution and the regulating apparatus.

The central station established in the Rue des Dames, at Batignolles, in a splendid building erected for the purpose, comprises a series of tubular boilers, producing steam at a pressure of from six to seven kilogrammes per square centimetre. This steam supplies three horizontal steam engines of the Corliss type, each driving a large dynamo, and three Armington & Sims engines of less power, each working two smaller dynamos. The only fact worth mentioning, from a mechanical point of view, is the intended and pre-arranged absence of condensation, notwithstanding the power to be produced, which exceeds 2,000 steam horse-power when all the machines are working. The economy of fuel effected by means of condensation in an installation on this scale is of little importance as compared with the increased simplicity and safety of working gained by its suppression. Each of these steam engines of 600 horse-power turns at an angular speed of 65 revolutions per minute and works directly a continuous current multipolar dynamo producing 700 amperes and 450 to 500 volts, or 350 kilowatts. These are the most powerful continuous current dynamos at 500 volts that have yet been made. The armature is a Gramme ring 3.3 metres in diameter and 5.4 centimetres in thickness, with eight fixed inner poles. This ring is mounted on a projecting star of 30 rays. It consists of a number of sheets of iron supported on spindles of bronze, fixed on to the star, which is cast iron. Fig. 1 shows the construction of this colossal armature; Fig. 2 shows the winding of it, the coil consisting of 2,000 spirals formed of rectangular bars of copper. This armature has no collector, properly so-called; the external portion of the bars with which it is wound serve to collect the current by means of eight series of brushes placed at 45 degrees from each other. As the speed of the outer bars attains 12 metres per second, the brushes must rest very lightly, in order to avoid wear and loss of work by friction. This result is obtained by mounting the brushes on flat brass springs, which gives them great flexibility. All the brushes, moreover, are mounted on one common frame, which enables them all to be brought in contact with the bars at once, and all to be at the same time brought into or displaced from the position corresponding to the suppression of the sparks, a position which varies according to the load on the machine.

The brushes can be displaced longitudinally along the rods which support them, so as to distribute the friction and equalize the wear, which is, however, very slight, of the collector. Fig. 3, which represents a dynamo of less power, but of the same type, shows clearly the arrangement of the armature collector and brushes, as just described. It is a type producing 160 kilowatts, used in less important stations. A model of this type was shown at the Universal Exhibition of 1889. The three large dynamos at the station of the sector of the Place Clichy differ from this type only in dimensions and power. The armature alone weighs eight tons, and special precautions had to be taken for its construction and transport from the works of the Alsatian Mechanical Construction Company at Belfort, where it was made, to Paris. The three dynamos are connected directly, in the plan of the works, with two thick bars of copper, between which a difference of potential of from 450 to 500 volts is maintained. The excitations of each dynamo is equally established between these two bars, and may be regulated by means of a rheostat introduced into the circuit. Each rheostat may be manipulated independently in order to allow of the introduction or suppression of each machine in derivation on the bars, but all the rheostats can be connected together and manipulated at the same time for purposes of general regulation.

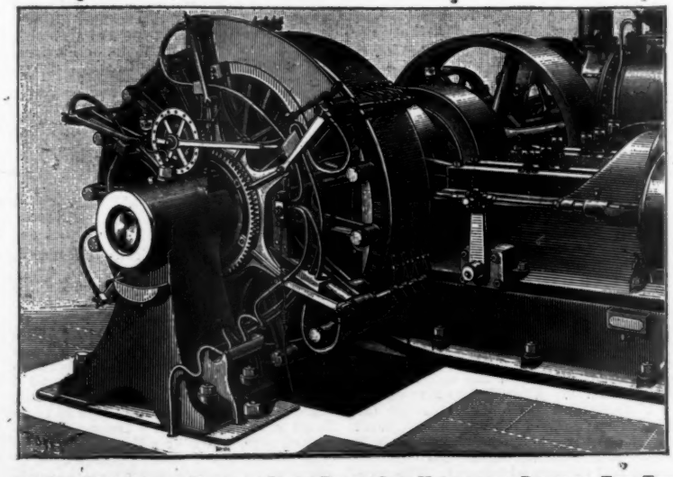


FIG. 3.—DYNAMO WITH RING AND INNER POLES; SIDE VIEW OF THE BRUSHES. THIS TYPE PRODUCING 160 KILOWATTS. TYPE OF 350 KILOWATTS INSTALLED FOR THE PLACE CLICHY.

### Edison Dividend.

The sixth quarterly dividend of two per cent. on all the stock of the Edison General Electric Company has been declared by the board of trustees, due and payable on May 1, 1891, at the office of the company, to holders of record March 27, 1891.

The transfer books will be closed at 3 P. M., on March 27, 1891, and reopened on May 2, 1891.

### Electrocution News.

A Washington dispatch of March 16, says that the United States Supreme Court advanced the case of Wood against Warden Brush of Sing Sing, and set it down for argument on the first Monday of April next. In the Jugiro case a new citation was ordered to be issued, directing the counsel for the prisoner to come into court on the same day Wood's case is to be heard, when argument will be proceeded with. It will be remembered that these are both appeals from refusals of the court below to grant writs of *habeas corpus* on alleged constitutional questions to the men named above, who are now under sentence of electrocution for murder.

## ELECTRIC LIGHT NEWS

—— Salisbury, Indiana county, Pa., is to have an electric light plant.

—— The Bangor, Me., Electric Light and Power Company has declared a 15 per cent. dividend.

—— Buffalo, N. Y., is agitating the question of municipal ownership of an electric light plant.

—— J. L. Peck, of Rochester, has secured a franchise for an electric light plant at Noblesville, Ind.

—— The city of Augusta, Ga., wants information and prices on electric light plant. Address R. H. May, mayor.

—— The Abingdon, Va., Water Works Company is to substitute an alternating electric light system for that now in use.

—— An ice jam at Veazie stopped the electric lighting plant which furnishes Bangor, Me., with light, and, as a consequence, the city was in darkness for one evening last week.

—— A friction clutch six feet in diameter on a shaft running 300 revolutions per minute at the plant of the Narragansett Electric Lighting Company, Providence, R. I., burst last week, injuring one man.

### Brooklyn Electric Light Companies to Unite.

For some time time past the stock of the two local electric lighting companies, the Citizens' and the Municipal, has been advancing in value and has jumped up from 120 to as high as 135 per share, says the Brooklyn *Eagle*. Capitalists and speculators have been trying to find a reason for this advance, but those interested in the stock of the company have managed to keep their secret. It has been known that something was up, but until now the public has been in ignorance as to just what that something was. It seems, however, that the purchasers of this electric light company stock have known just what they were about, for it was announced, Wednesday last week, that the two companies intended to combine and form one concern. The Citizens' and Municipal Electric Light Companies are capitalized at $500,000 each. The new combined company will be capitalized at $2,000,000. Among those who have recently made heavy purchases of this stock is Edward Bushnell. He is a son-in-law of Bub McLoughlin, the nephew of Boss McLoughlin, and it is understood that Bushnell is buying for the people who have long controlled the Citizens' Electric Light Company, of which John Delmar is president and Thomas Nevins treasurer and secretary, and E. F. Peck the well known and efficient superintendent. It is said that the new company will purchase a site near the City Hall and erect thereon a handsome office building, and that Matthew Dean, president of the Municipal Company, will be president of the new concern and Thomas Nevins its treasurer and secretary. This is probably the business to which Chief Nevins' friends referred some time ago when they said he intended to retire from the fire department and enter commercial life. There is great speculation among those who have heard of the proposed combination as to what effect it will have upon the price of electric lighting in Brooklyn. This new company will absolutely control all the electric lighting in the eastern and western districts and is credited with having sufficient political pull to prevent any rival companies in starting in opposition to it. The talk is that it will put up the price of electric lighting. Electric lighting in Brooklyn has always been of the best quality, the result of a fair price and good technical and business management.

## Inductive Disturbances in Telephone Circuits.

BY J. J. CARTY, BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MARCH 17, 1891.

It was not known until 1838 that the earth might be used instead of a return wire in the circuit of a telegraph line. This fact was discovered by Steinheil while making experiments to determine whether the track of a railroad could be used to complete the circuit instead of a return wire. Steinheil's discovery has been considered as one of the most important in the art of telegraphy, and since his time it has been the almost universal practice to use the earth as a return in telegraph circuits. When, however, the earth return is used with the telephone, it is found that, owing to the extreme sensitiveness of that instrument, many foreign currents, which would produce but little effect on telegraph instruments, become a source of serious trouble. For this reason, in telephony it is often necessary to use a complete metallic circuit. Thus it has come to pass that a return to the original practice of employing metallic circuits, as in the case of the crudest telegraph instruments, is now regarded as a most important improvement in connection with that most highly developed of telegraph instruments, the telephone.

To obtain complete freedom from inductive disturbances in the telephone, it is necessary not only to use a metallic circuit, but to place the two wires composing the circuit in a special relation to the source of disturbance. One of the methods of so arranging the wires is shown in Fig. 1.

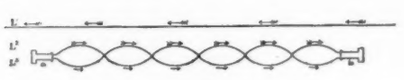


FIG. 1.

In this case the two sides of the circuit $L^2$ and $L^3$ are twisted spirally about each other, so that their average distance from the disturbing wire $L^1$ shall be the same. With such a plan, the telephones $a$ and $b$ are not affected by induction from the wire $L^1$. This fact has usually been explained by assuming that a current, commencing to flow in $L^1$, tends to induce two currents in the opposite direction to itself, one in the wire $L^2$ and the other in the wire $L^3$; that both currents are of the same strength, because the average distance of $L^2$ and $L^3$ from the disturbing wire $L^1$ is the same; and that the telephones $a$ and $b$ are silent because they are acted upon by two equal and opposite forces. The above theory seems at first sight to be correct, and indicates the line of explanation adopted in many works treating of the subject.*

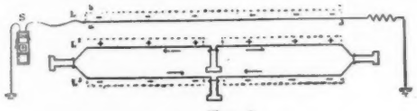


FIG. 2.

I have made a number of experiments which seem to prove that in the case described, the inductive action, instead of tending to produce a simple current in each side of the metallic circuit, actually does produce a number of different currents in each wire and in both directions.

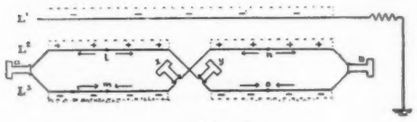


FIG. 3.

In Fig. 2, $L^2$ and $L^3$ are two well insulated copper wires, 500 feet long and three feet apart. These wires are joined together at each end through an ordinary telephone. $L^1$ is a well insulated wire, similar to the other two, and placed within one-half an inch of $L^2$. At one end of $L^1$ is placed a Blake transmitter T, and at the other end is placed a subscriber's bell S; $L^1$ being grounded at both ends, as shown. When the transmitter T is operated, either by speaking into it or by vibrating a powerful tuning fork in front of it, disturbances are produced at the end telephones.

If telephones are inserted at the center of $L^2$ and $L^3$ it is found that at those points no sound is heard, while the noise of the end telephones continues as before. This constitutes a simple case of inductive disturbance, and can only be explained by assuming that the wire $L^1$ acts electrostatically upon the circuit composed of $L^2$ and $L^3$, or, in other words, that we are dealing with a system of condensers in series, of which $L^1$ constitutes one plate, the earth another and the wires $L^2$ and $L^3$ two intermediate plates which are joined together through the end telephones.

Let us assume that at a given instant the height of potential along the wire $L^1$ is represented by the lines $a\,b$ and $c\,d$, and the charge upon $L^1$ by the rectangle $a\,b\,c\,d$. The presence of this charge, which we will say is of the minus sign, is accompanied by an equal but plus charge on $L^2$. This produces a minus charge on the wire $L^3$, which in turns acts upon the earth. Now, we will assume that the potential on $L^1$ is reduced to zero. This causes a restoration of the equilibrium in the circuit composed of $L^2$ and $L^3$ which is accompanied by a set of currents as represented by the arrows. The plus charge on $L^2$, flowing through the end telephones, neutralizes the minus charge on $L^3$, thus leaving a neutral point at the center of each of the wires $L^2$ and $L^3$.

FIG. 4.

In this and the succeeding experiments the induced charges are represented by rectangles. This is not a strictly accurate method, but as an error in this respect only affects the result quantitatively, and cannot alter the conclusions, I have adopted, it on account of the simplicity of treatment which it permits.

The potential along the wire $L^1$ at a given instant is represented as being constant, as it is found that owing to the high impedance in the instrument S, there is practically no fall of potential in the wire itself. Furthermore, it was found in the experiments about to be described that the results were the same whether the disturbing wire was open or connected to earth through the bell S. There would be a fall of potential along the wire $L^1$ if it were of such a length as often found in practice, and the distribution of the charge would be modified accordingly. But as this fact would only affect the location of the neutral points, the question of the fall of potential will not be taken into consideration and the disturbing wire will be shown open at one end.

Fig. 3 shows the same circuits as used in the previous experiment, except that the wires $L^2$ and $L^3$ are caused to change places at their centers but are continued in the same plane, as in Fig. 2. This is what is called a "transposition." The telephones at the ends and in the middle are retained as before. Under these conditions, when the transmitter is operated, a diminished sound is heard at $a$ and $b$; and $x$ and $y$, instead of being silent, as in the first case, now emit a sound of the same intensity as $a$ and $b$. When telephones are placed at the quarters $l$, $m$, $n$, $o$, the sounds at $a\,b$ and $x\,y$ continue as before, but nothing is heard at $l$, $m$, $n$, $o$. The effect of this one transposition has been to reduce the disturbance at the end telephones $a$ and $b$, and to cause a shifting of the neutral points from the centers to the quarters, and an increase of their number from two to four.

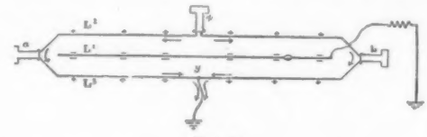


FIG. 6.

An examination of the induced charge shows how these results have been brought about. It will be seen, by reference to Fig. 3, that there is on the first half of $L^2$ a positive charge, and on the second half a negative charge, and on the first half of $L^3$ a negative charge, and on the second half, a positive charge. When the positive charge on $L^3$ discharges, half of it goes through the telephone $a$, and half through the telephone $y$. The positive charge on $L^2$ escapes in a similar manner, half going through telephone $x$, and half through telephone $b$. This produces four currents, two starting from point $l$ and two starting from the point $n$. One of the currents from $l$ meets a current at $o$, coming from the point $n$, and one of the currents starting at the point $n$ meets a current at $m$, which started from $l$. The currents flowing through the end telephones in this case are not so strong as when no transposition is employed, because they are due to an induced charge which is represented by an area half as great. It is found that as the number of transpositions is increased the number of neutral points is also increased, and that the area representing the charge, which escapes through the end telephones, is reduced. To obtain silence, therefore, it is necessary to increase the frequency of transpositions until the discharge through the end telephones is so small as not to produce sounds therein. Fig. 4 shows a circuit containing three transpositions, one at the center and one half-way between the center and each end. In this case, if we could neglect the resistance of the telephones, the current going through the ends would be reduced to one-fourth of its original proportions, and eight neutral points would be produced, one in each wire at the center of each transposition.

In practice the impedance of the telephones must be taken into consideration, so that if, in Fig. 3, the middle telephones $x$ and $y$ were omitted, the neutral points would be found to move towards the ends, and the currents flowing through the end telephones would be correspondingly reduced.

According to this theory of transpositions, if the instruments and distances between wires on a given circuit remain constant for a given period of alternations in the disturbing wire, the number of transpositions necessary to obtain silence will depend on the E. M. F. of the disturbing wire and the specific inductive capacity of the dielectric. An increase in the value of either of these factors will, if silence is to be maintained, require additional transpositions, their number depending upon the value of the change which is made.

Where the disturbing wire is placed at an equal distance from both sides of a metallic circuit, no noise is produced in telephones located in that circuit, and a balance once being obtained, it is independent of both the E. M. F. of the disturbing wire and the specific inductive capacity of the dielectric. Fig. 5 shows such an arrangement of circuits—$L^2$ and $L^3$ are the two wires composing the metallic circuit placed the same distance apart as before, and the disturbing wire is at an equal distance from both. When the disturbing wire is in operation, no sound is heard at the end telephones, or at telephones located at the centers. This may be accounted for by assuming that at a given instant a negative charge is on the disturbing wire, which produces a positive charge on the inside of $L^2$ and $L^3$ and a negative charge on the outside of those wires; and that when the charge is removed from the disturbing wire, a set of currents is set up in the wires $L^2$ and $L^3$ in a direction at right angles to their axes, as shown by the arrows. In this case the flow is lateral, and no current passes through the end telephones or through telephones located at the centers. It will thus be seen that this method of arranging wires differs essentially in its action from the plan of using transpositions. Unfortunately, however, its practical application is limited to two circuits.

FIG. 5.

Where the disturbing wire occupies the position shown in Fig. 5, the flow in the conductors is lateral only when the wires $L^2$ and $L^3$ are insulated from the earth. If a ground be attached to the center of $L^3$, as shown in Fig. 6, the flow of current becomes longitudinal, and the telephones $a$ and $b$ are found to be affected by loud disturbances, while the telephone $x$, at the center of $L^3$, is found to be silent. This is because the disturbing wire, which we will say is negatively charged, induces a positive charge upon $L^2$ and a negative charge upon the earth. The discharge in this case is effected by two currents starting from $x$, which thus becomes a neutral point, and passing through the end telephones to the ground, as shown by the arrows. If the ground be removed from the point $y$ toward the telephone $a$, the neutral point will be found to move toward telephone $b$, and if the ground be put at the center of resistance of the telephone $a$, the neutral point will be found to be at the center of the telephone $b$. This is well illustrated in Fig. 7, where $a$ and $b$ are telephones of special construction, admitting of the attachment of grounding keys $K^1$ and $K^2$ at their respective centers. In this instance, when the disturbing wire is in operation and both keys open, no sound is heard at any of the telephones, the flow of current being lateral. If the key $K^1$ be closed, sound is immediately heard at telephones $x$ and $y$ located at the centers of $L^2$ and $L^3$, but the telephones $a$ and $b$ are still silent. This is because the charge and discharge take place along the conductors $L^2$ and $L^3$ to and from the earth at $K^1$, thus passing through $x$ and $y$, $a$ being silent because the currents go through it differentially, and $b$ is silent because it is located at a neutral point. To prove that current flows through telephone $a$, another telephone may be inserted in the ground branch at $K^1$, and it will be found to be loudly affected. If both keys $K^1$ and $K^2$ are closed, silence is again obtained in the four telephones, $a$, $b$, $x$, $y$. In this case the charge and discharge from the wires $L^2$ and $L^3$ divide at the center and flow back and forth at both ends, $x$ and $y$ being silent because they are at neutral points, and $a$ and $b$ are not affected by the currents which flow through them because of the differential action referred to.

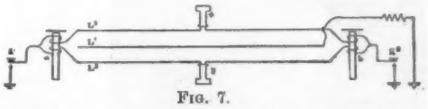


FIG. 7.

Two systems have now been described, one in which the induced current is lateral, and the other in which it is longitudinal. I think it follows from the foregoing experiments, that where wires are twisted about each other, as shown in Fig. 1, both of these actions are combined. At the left hand of Fig. 8, a cross section of three wires $L^1$, $L^2$ and $L^3$ (Fig. 1) is shown. In this position the wires occupy a place with reference to each other exactly as in Fig. 2, and the tendency of the disturbing wire is to cause a longitudinal flow in $L^2$ and $L^3$. If repeated cross-sections of these wires are made, a point will be reached at which the three wires are disposed as shown at the right hand of Fig. 8, where it is seen that the disturbing wire $L^1$ is at an equal distance from $L^2$ and $L^3$, and the tendency is to produce a lateral flow. The actual currents produced must be the resultant of these two actions.



FIG. 8.

Fig. 9 shows a plan quite different in principle from anything heretofore employed. It is of interest, not so much on account of any practical application which it may have at present, but because it is a very striking proof of the electrostatic nature of inductive cross-talk between telephone circuits. $L^1$, $L^2$ and $L^3$ are the same wires as used in the previous cases, $L^1$, being half an inch from $L^2$, with the addition of an extra wire $L^4$ placed half an inch from $L^3$ and joined by a conductor $w$ with the disturbing wire $L^1$. $L^2$ and $L^3$ are three feet apart. When in this condition the transmitter is operated, no disturbance whatever is heard in the end telephones; if the wire $w$ be disconnected, the usual noise is heard, but is found to disappear as often as $L^1$ and $L^4$ are joined together. This action is explained by the fact that $L^4$ is at the same potential as $L^1$, on account of being joined to it by the wire $w$, and acts with the same force on $L^3$ that $L^1$ does on $L^2$. The flow in this case is lateral, as indicated by the arrows, and the telephones are silent.

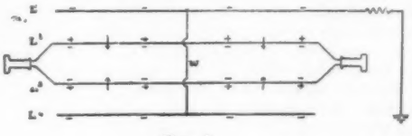


FIG. 9.

Neutral points may be produced in a circuit by the use of shunts. Fig. 10 shows the usual arrangement of circuits with the telephones $a$ and $b$ at the ends, and another telephone $x$, of equal impedance branched between the two wires at the center. In this case four neutral points are found, two in each wire. The currents produced by the discharge are indicated by the arrows. Thus by the addition of one shunt, the disturbing currents in the end telephones have been reduced one-half. If similar shunts were placed at the quarters, the currents at the end telephones would be still further reduced to one-quarter of their original strength.

* "A Hand-book of Practical Telegraphy," R. S. Culley, 1885, p. 330. "The Telephone," Preece & Maier, 1889, p. 134. "Die Technik des Fernsprechwesens," Dr. V. Wietlisbach, 1886, p. 135.

This plan is not a practicable one because of its shunting effect on the telephone current, but it is of value as showing one of the actions which occur when instruments are bridged into metallic circuits. It is interesting to note that in Fig. 10 the telephone $x$ is affected by a current twice as great as that which flows through either of the end telephones.

Before closing, I shall describe one more experiment. Fig. 11, $L^1$ is the disturbing wire and $L^2$ is a grounded telephone circuit placed one-half an inch from $L^1$. At the center of $L^2$ there is an ordinary telephone repeating coil or transformer C, containing two windings, $e$ and $f$, of copper wire, each having a resistance of 160 ohms. One end of each winding is grounded, and the other end is connected to the line as shown. Assuming that the impedance of each telephone is equal to that of each coil of the trans.

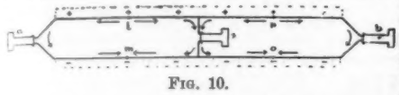


FIG. 10.

former, a neutral point will be found at the center of each half of $L^2$ and the disturbing currents flowing through the end telephones will be only half as strong as though the transformer were omitted. If, now, the connections of the transformer be reversed, so that the discharges from the two sections of line pass through it in opposite directions, no magnetism will be produced in the core $k$, and consequently the transformer coils offer an easier path to the discharge. This causes the neutral points to move toward the end telephones and consequently reduces the disturbance still further.

I have not had an opportunity of trying this experiment with a transformer whose

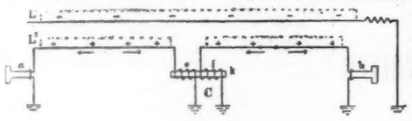


FIG. 11.

coils contained a low copper resistance and a high inductance, but according to theory, we might expect that such a transformer having its coils connected differentially, should free a grounded line of considerable length from cross-talk and other electrostatic disturbances. The number of such coils which can be worked in a given line is, of course, limited, but with properly designed apparatus a large number of them might be used. This arrangement is also interesting when considered with reference to electro-magnetic induction, and brings to mind a question as to whether we may not at some future time abandon the use of metallic circuits and again make use of Steinheil's discovery.

### The Electric Transmission of Power.

It is an essential condition with most prime movers that they should run constantly at or about the same speed, whatever may be the variation in the load. As the work increases on a steam engine the governor admits more steam, and as the work diminishes the supply of steam is reduced. In an electric motor, however, the supply of current cannot be regulated by a device like a throttle valve, and uniformity of rotation has to be attained by other means. An investigation into conditions of electric motors favoring automatic regulation, formed the chief part of Mr. G. Kapp's second Cantor lecture on "The Electric Transmission of Power."

Electric motors may run under either of two sets of conditions. When they receive their current from the mains of a supply company, which is the usual condition of small machines in towns, there is a constant pressure at the terminals. When a special generator is erected to supply current to a distant motor then there is constant or variable pressure with a variable power absorbed by the generator. If a series motor be employed with constant pressure at the terminals, then, with light loads, the speed will run up until the counter electromotive force is nearly equal to that at the terminals, and the current is reduced to a small amount. The strength of the field will fall off as the speed is increased, since the same current circulates in it as in the armature. An increase of load will demand an increase of current both in the armature and field, but since the counter electromotive force in the armature depends both on the speed and the strength of the field, it follows that a large current means decrease of speed, or in other words, that the motor runs slower when fully loaded than when lightly loaded.

A shunt motor does not suffer from the variation of current through its field coils. As long as the difference of potential remains constant, the same current will always flow whatever may be the load on the armature. By varying the electromotive force by the insertion of resistances the speed can be altered accordingly. To demonstrate this Mr. Kapp first ran a shunt-wound motor with a difference of potential at the terminals of 70 volts; the speed was 358 revolutions per minute. He then raised the potential to 92.5 volts by taking out resistances, when the speed became 455 revolutions. The speeds were shown to be proportional to the electromotive forces, within the limits of error of a platform experiment. This method of regulation is, however, wasteful, since the resistance consumes energy without giving any useful return. Further, if the loads be very heavy, the armature exercises a demagnetizing effect on the field magnets, and the field no longer remains constant. Another method of varying the speed of a shunt motor is by varying the strength of the field. If the field be strong a moderate speed gives a high counter electromotive force, while, on the contrary, with a weak field the armature must run fast before the electromotive force nearly balances that in the mains. Mr. Kapp had devised a very striking method of illustrating this to his audience. A motor, supplied with current from a source outside the hall, drove a dynamo, in the circuit of which was an arc lamp. It was easy to see from the light given off how the speed of the dynamo was altered by modification in the field of the motor. At starting, the lamp just maintained its arc and nothing more, but when resistance was added to the magnet circuit of the motor, a long arc was drawn and abundant light given off, thus showing that both increased speed and power were obtained. The conditions of the experiment corresponded to a case where the speed is not required to be uniform but to be capable of easy regulation. For a constant speed under varying loads a shunt motor regulates automatically. This was shown by experiments published by Mr. Mordey in the *Philosophical Magazine* for January, 1890. With a supply at 140 volts pressure, and a load varying between 1.8 and 16.3 horse-power, the difference of speed was only three per cent. The condition requisite for good regulation is that the loss of voltage in the armature, due to the resistance, must balance the armature reaction on the fields. That is, that the demagnetizing effect of the armature on the field, which would give rise to an increased speed of rotation, must be met by a loss of electromotive force in the armature itself, the field strength and the electromotive force increasing and decreasing together. If the motor be compound wound, the effect of the series coils is to weaken the field, or to assist the armature reaction. Experiment showed that the motor in the lecture room ran about eight per cent. faster loaded than when light; the armature resistance and reaction did not exactly balance each other.

When the current is not taken from general supply mains, but from a special generator, it is possible to use series, compound or shunt motors. If both generator and motor be series wound, it is possible to design them to give constant speed at all loads. When the current driving a motor is derived from a series-wound dynamo, neither the current nor the electromotive force is constant. But if the motor be series-wound, also, the two machines will correct each other, and the motor will run at a certain speed under a varying load if the generator be driven at a constant speed, provided the two machines be designed for the purpose. This end is attained when the electromotive force of the motor, under all currents, is less than the electromotive force of the generator, by the amount of pressure lost in overcoming the combined resistances of the dynamo, motor and line. Then, under any current, that is, under any load, the counter electromotive force of the motor, at the given speed, equals the electromotive force of the generator, less that expended in overcoming the resistances. As a matter of practice, it is possible to render a series motor, driven by a series generator, self-regulating over a considerable range of load. Additional accuracy of regulation can be obtained by the use of a large non-inductive shunt across the field coils. This shunt increases the rapidity with which one machine corresponds to the other. If the load on the motor be suddenly diminished, the current will be as suddenly checked. The shunt acts as a kind of electro-magnetic damper or dash-pot, and prevents the surging due to the slowness of the field magnets in adjusting themselves to changes of current.—*London Engineering.*

### A Review of Electrical Progress in 1890.

The next regular meeting of the New York Electrical Society, on Friday, March 27, at eight P. M., will be held by invitation at the Electric Club, No. 17 East Twenty-second street, this city.

Mr. Jos. Wetzler will deliver a lecture on "Electrical Progress in 1890," in which he will devote particular attention to the practical advances which have been made during the past year.

The meeting will be one of special interest, due to the fact that many prominent inventors will be present to describe in person, and with the aid of models, the improvements made by them. Among the inventors who will assist, we may mention Nikola Tesla, J. J. Carty, P. B. Delany, J. C. Chamberlain, C. O. Mailloux, F. J. Patten, J. C. Henry, Dr. W. E. Geyer, W. H. Bristol, G. W. Walker, F. B. Crocker, and others. The lecture will begin promptly at eight.

The subject touched upon will embrace the departments of electric lighting, continuous and alternating motors, thermo-magnetic generators, telegraphs, telephones, electric measurement, primary and storage batteries, electric railroading, etc.

### Wirt Volt Indicator.

The Electrical Supply Company, of Chicago, have just placed upon the market the Wirt volt indicator. It is the outgrowth of a series of extensive tests and experiments, and it is claimed that the indicator combines reliability and accuracy in the highest degree. It has a case of cast-iron with glass front and a cast-brass rim, being thus protected from moisture, heat and dust. Magnetic attraction with gravity control is the principle of action, and the design and construction is such that "magnetic memory" is practically eliminated. There is nothing whatever, it is claimed, about this instrument that will permit of a gradual variation from truth, such as often happens with instruments employing heating effect, variation of resistance or permanent magnetism, as moving or controlling force.

The resistance of the indicator is chiefly made up of a new alloy not yet made public, the feature of which is permanency, with a remarkably small temperature variation. The resistance of the indicator is sufficiently

high to be used on iron pressure wires without making allowance, except in the case of unusually long wires. The instrument has a direct reading scale and an arrangement of a movable index, by which the deflection can be read at a distance of 20 feet, a deviation of one-half to one per cent. easily perceived. No gears or springs are employed; no multiplying devices; no hot wires or pulleys; no uncertain carbon resistance. There is but one moving part, namely, a cylindrical iron needle .005 of an inch thick, and of a shape making it stiff and free from distortion. This and the attached pointer of aluminum are pivoted in the same manner as the main spindles of a first-class chronometer. The Electrical Supply Company back their confidence in their instrument by the following clause contained in the accompanying directions: "Let it alone. If any one tells you the indicator fails to agree with his idea of what is correct, send to Johns Hopkins, Cornell or Michigan State University for comparison at our expense, if found two per cent. wrong and seal is unbroken."

## ELECTRIC CLUBS.

### New York Electric Club.

**Mr. Franck Z. Maguire,** one of the Club's most popular members, is rapidly convalescing from a six weeks' illness.

**The Regular Meeting of the Electric Club** was held Tuesday evening of last week, at the Club House, to nominate officers for the year beginning May 1 next. The meeting was held in the library, Mr. H. L. Storke acting as chairman. Nominations were made in open convention and resulted as follows:

President: O. E. Madden.

Vice-Presidents: S. Insull, Chas. W. Price, E. Wiman, W. D. Sargent.

Secretary: Franck Z. Maguire.

Treasurer: Geo. B. Coggeshall.

Board of Managers: H. L. Shippy, Dr. J. B. DeLery, P. H. Alexander, H. D. Cheever, T. C. Martin, C. D. Shain, C. E. Stump, Joseph Barré, E. F. Peck, C. O. Baker, Jr., E. E. Bartlett, H. D. Stanley, J. H. Herrick.

Committee on Membership: C. H. Barney, Geo. T. Manson, J. C. Chamberlain, S. S. Wheeler, Joseph Wetzler.

During the nominations several of the former officers of the Club were suggested, but asked to be permitted to decline, several stating that they would be unable to attend to the duties of the positions. Among these were Capt. W. L. Candee, who has been for years the treasurer of the Club; Mr. H. L. Storke, Mr. H. C. Adams, Mr. H. A. Reed, the last-named gentleman having been an efficient member of the Board since the first year of the Club's existence.

**The Annual Election** of the Club will be held Thursday evening, April 16.

**Recent Out-of-Town** visitors were: E. Conklin, Racine, Wis.; Samuel H. Pine, Washington, D. C.; Gen. Geo. A. Sheridan, introduced by Mr. Felix Gottschalk; C. L. Tolles, Hartford, Conn.; Thos. M. Hart, New Bedford, Mass.; L. J. Demers, Quebec, Canada.

**Mr. Morris W. Meade,** a member of the Club, is doing good missionary work in his native city, Pittsburgh, in organizing an Electric club. Mr. Meade is wide-awake every day (and many nights) in the year, and will undoubtedly make the scheme a success.

### American Institute of Electrical Engineers.

**With the Co-operation** of Mr. Carty, who took great pains to prepare his copy and drawings, Mr. Ralph W. Pope, secretary of the Institute, was able to have Mr. Carty's paper, read at the last meeting, in type in advance, so that an opportunity was afforded the members to discuss it understandingly. The paper appears in full in this issue of the REVIEW.

**At the Regular Monthly Meeting** of the council, held March 17, the following associate members were elected: Adolph G. Greenberg, Walter E. Harrington, George W. Tuttle.

**The Meetings of the Council** are now held at five instead of seven o'clock, P. M., on the third Tuesday of each month, the same dates as the monthly Institute meetings. The change of hour proves to be very satisfactory.

### The New England Society, of Orange, N. J.

**The New England Society,** of Orange, spent most of its time at a recent meeting in discussing the resolution presented last month by the committee on public welfare, condemning the trolley system of electric railways. The resolution was finally adopted by a large majority. It is as follows:

"We recognize the desirability of rapid transit for the Oranges; that we disapprove of the introduction of the trolley system of electric railways upon any street or thoroughfare intended for ordinary travel or business purposes, and deem it best for the interest of all the Oranges that no further permission to use the trolley system should be granted; that it is for the best interest of all the communities to put up with the inconvenience of the present means of communication until the storage battery system for electric railroads can be satisfactorily introduced; that in any system of rapid transit proper regulation of speed should be enforced, and that every means should be taken to protect to the utmost human life and property."

### New York Franklin Society.

**The Meetings** of the Franklin Electrical Society will hereafter be held on the second and fourth Saturdays of the month. The next meeting will be held Saturday, March 28, at eight P. M., at rooms, 239 and 241 East Fifty-seventh street. A paper on "Electric Traction" (elementary) will be read by M. L. Newman. Visitors are invited to attend.

## KINDRED INTERESTS

**The Estey Manufacturing Company,** Owosso, Mich., wants two second-hand arc dynamos, capacity five arc lamps each, and a high speed engine with incandescent dynamos 350 lights capacity, immediately.

**The Electric Merchandise Company,** 11 Adams Street, Chicago, have been appointed the selling agents for the Tramway Rail Company, of Pittsburgh, Pa., manufacturers of steel rails of all descriptions, chairs, tie plates, splice bars, frogs, switchings, crossings and other street railway equipment.

**The Brown & Sharpe Manufacturing Company,** Providence, R. I., are building a new four-story brick building, 100 feet long and 56 feet wide. The construction is similar to that of the main machine shop buildings, and is practically fire-proof throughout. The building will be devoted to the manufacture of a variety of small tools and instruments for accurate measurements.

**Reed & McKibbin.**—The co-partnership heretofore existing under the firm name of Thompson, Reed & Co., electrical engineers and contractors, with offices at 32 Liberty street, New York, was dissolved by mutual consent on the 23d of January, 1891. Messrs. Reed & McKibbin, members of the late firm, will continue in the same business at the old address until May 1, 1891, when they will move to 2 Wall street, corner Broadway.

**The Electrical Supply Company,** Chicago, is recommending the Simpson storage battery for surgeons' cautery work, for experimental work, for electrical workshops in calibrating and electrical measurement, for lighting and power on a small scale, charging the batteries from a dynamo or from primary batteries for lighting purposes where a safe portable light is needed, as for work about gas furnaces, powder mills, in varnishing beer tanks, in distilleries and varnish factories. In a great many applications it will be possible to replace primary batteries with these small, cheap, powerful storage batteries, saving both money and the vexation that accompanies the use of even the best chemical generator.


## AUCTION NOTICE.

HENRY B. HERTS' SONS. Auctioneers,

Will sell on Monday, March 30, at 11 o'clock, at the private mansion, *No. 149 Second Avenue, near Tenth Street,* the Celebrated Barrow Collection of Electrical and Scientific Apparatus. Being a large and valuable assortment of Galvanometers, Giesler Tubes, Batteries, Air Pumps, Holtz Machine, Electro-Magnets, Fine Microscope, with Numerous Lenses, etc., etc. Collected by the late John Wylie Barrow, Esq., Founder and First President of the Franklin Scientific Association.

The goods will be on exhibition on Saturday, March 28, with descriptive catalogue.

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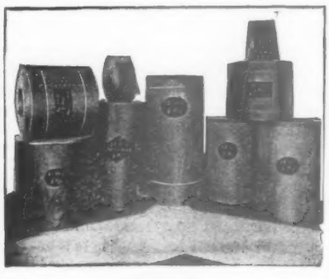

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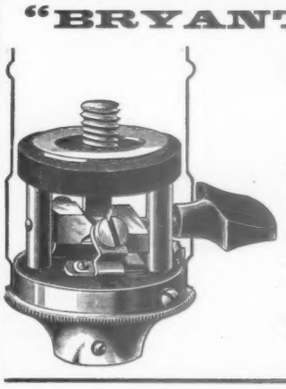

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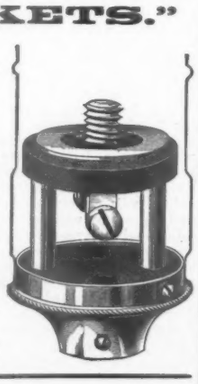

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## ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON MARCH 17, 1891.

448,199 Electric motor truck; Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Co., of Connecticut.
448,246 Support for electric wires; Chas. A. Lieb, New York, N. Y.
448,260 Motor suspension for railway work; Edwin W. Rice, Jr., Lynn, Mass.
448,271 Electric typewriting machine; Edw. J. Silkman, Baltimore, Md., assignor of two-thirds to Geo. D. Perminan and Thos. K. Worthington, both of same place.
448,273 Electrically controlled valve. 448,274 Electric temperature regulator; John V. Stout, Easton, Pa.
448,279 Electric lighting system; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.
448,280 Electric meter; Elihu Thomson, Swampscott, Mass.
448,294 Circuit closer for clocks; Henry A. Chase, Boston, Mass.
448,308 Driving mechanism for dynamo-electric generators; Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Co., same place.
448,317 Electric sad-iron; Chas. E. Carpenter, Minneapolis, Minn., assignor to the Carpenter-Nevens Electro-Heating Co., same place.
448,322 Callsystem; Louis Didgeon, Paris, France.
448,325 Electric alarm clock; Edw. M. Edgerton, Chicago, Ill.
448,326 Method of and apparatus for developing mechanical motion from electrical energy; Rudolf Eickemeyer, Yonkers, N. Y.
448,328 Electric railway; Justus B. Entz, New York, N. Y., assignor to the Waddell-Entz Electric Co., same place.
448,329 Telephone; Stephen D. Field, Stockbridge, Mass.
448,331 Commutator brush; Karl G. Frietsch, Schenectady, assignor to the Edison Machine Works, New York, N. Y.
448,331 Electric arc lamp; Karl Kurmayer, Vienna, Austria-Hungary.
448,359 Support for electric cables; Henry B. Nichols, Boston, Mass.
448,365 Electric switch; Ransom D. Pratt, Marlborough, Mass., assignor of two-thirds to Julian P. Wood and Herbert J. Willard, same place.
448,378 Electrical street and station indicator; Francis H. Soden, Chicago, Ill.
448,395 Insulator; Geo. K. Wheeler, Chicago, Ill.
448,404 Process of and apparatus for electrically reproducing irregular or undulating surfaces; Noah S. Amstutz, Cleveland, O.
448,418 Electric arc lamps; James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y.
448,431 Electric switch; Edw. H. Johnson, New York, N. Y.
448,461 Underground conduit for electric railways; Robt. A. Stewart, Allegheny, Pa.
448,468 Electric wire support and cut-out; Edwin R. Whitney, Manchester, N. H., assignor to the Electrical Supply Mfg. Co., same place.
448,505 Trolley support for electric cars; Benjamin F. Crow, St. Louis, Mo., assignor to the Brownell & Wight Car Co. of Missouri.
448,525 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Co., Boston, Mass.
448,540 Commutator truer; David McGenniss, Amsterdam, N. Y.
448,541 Process of making iodine by electrolysis; Thomas Parker and Alfred E. Robinson, Wolverhampton, England.
448,561 Electric railway motor. 448,562 Electric locomotive. 448,563 Electric railway system; Chas. J. Van Depoele, Lynn, Mass.
448,598 Electric transportation system; Schuyler S. Wheeler and Chas. S. Bradley, New York, N. Y., assignors to said Wheeler, trustee.
448,603 Electro-magnetic motor; Edwin D. Chaplin, Holliston, assignor to Eugene Humphrey, trustee, Boston, Mass.
448,604 Electric cable; William A. Conner, Pittsburgh, Pa., assignor to the Standard Underground Cable Co., same place.
448,618 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Co. of America, same place.

## PROPOSALS FOR ELECTRIC LIGHTING.

Notice is given that sealed bids are solicited for the lighting of the streets of the Borough of Asbury Park with seventy-five electric lamps of two-thousand candle-power, to BURN ALL NIGHT FROM JUNE 1 TO OCTOBER 1, and UNTIL 1 A. M. FROM OCTOBER 1 TO JUNE 1.

The contract to run for the period of one to five years, at the option of the Board of Commissioners, from June 15, A. D., 1891. The Borough to reserve the right to reject any or all bids, which must be presented on or before April 6, next, 12 o'clock, noon, when said bids shall be opened.

All bids must be accompanied by a certified check for $1,000 payable to the order of the Borough of Asbury Park as an evidence of good faith on the part of those making them and to be forfeited to the borough in case said contract is not performed by the firms or corporation to whom it is awarded. For map showing location of lights which shall be designated by the borough and for any other information, address F. L. TENBROECK or WILLIAM H. SMITH, of Asbury Park. Bids should be addressed to

C. T. BAILEY,
*Clerk Board of Commissioners,*
Asbury Park, N. J.


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